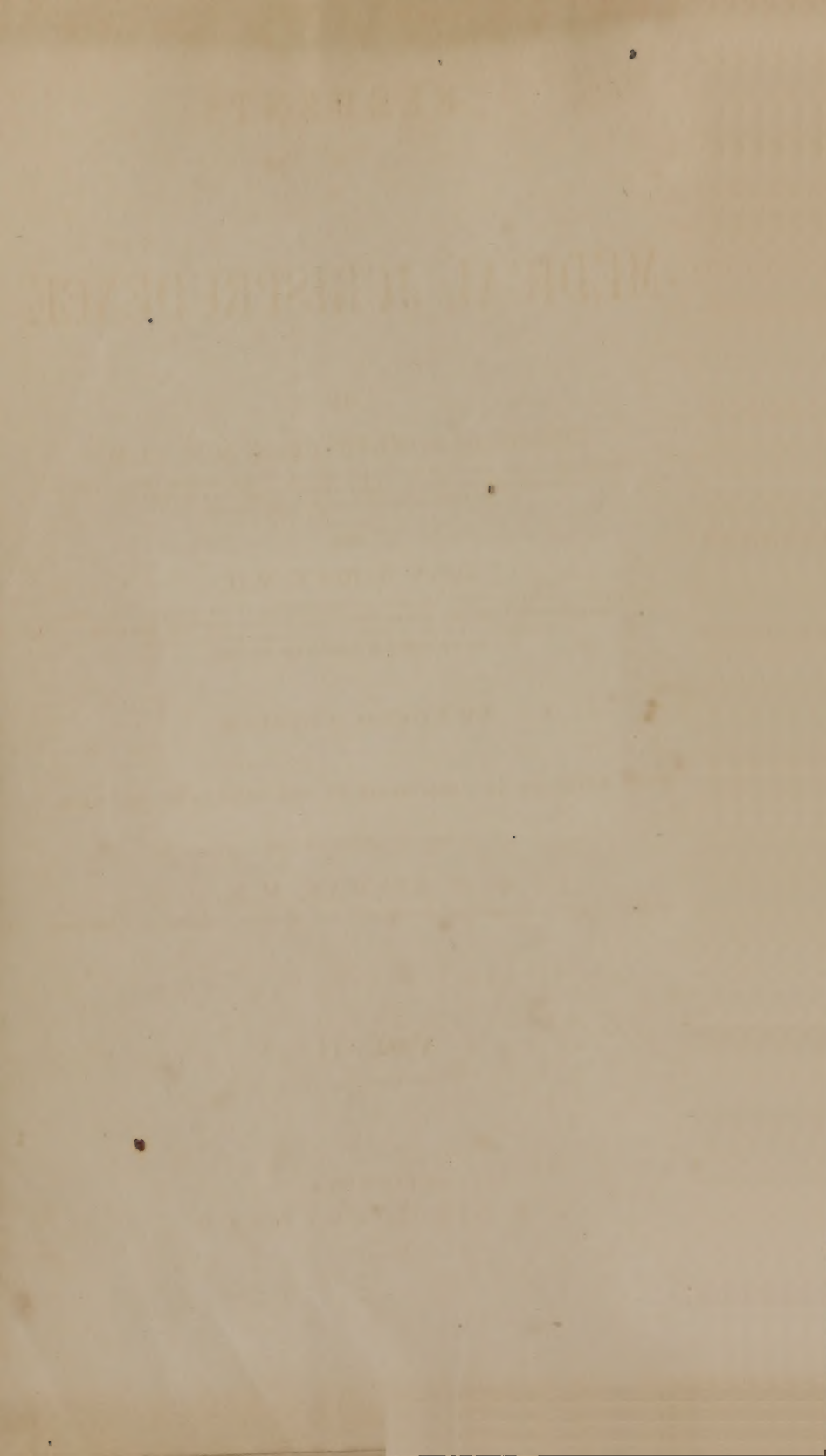


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TWELFTH EDITION.

WITH NOTES BY AN ASSOCIATION OF THE FRIENDS OF DRS. BECK.

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MEDICAL JURISPRUDENCE.

CHAPTER XIV.

PERSONS FOUND DEAD.

Duties of the office of coroner—imperfect manner in which they are often executed—duties of medical witnesses. Frequency of sudden death independent of violence.

1. MEDICO-LEGAL DISSECTION. Preliminary directions. Examination of external lesions—of the head—spine—thorax and abdomen. Distinction between natural appearances and the effects of violence. Hemorrhage—fluidity of the blood—ecchymosis—effect of blows on the dead body—sanguineous congestions—wounds—pseudo-morbid appearances. Examination of the skeleton—cases. Whether the hair grows after death. Changes induced by death and putrefaction. Observations of Orfila on this—not to prevent medico-legal dissection.
2. OF SUDDEN DEATH FROM NATURAL CAUSES. From apoplexy—rupture of aneurisms or cysts—affections of the heart—hemorrhage—idiopathic asphyxia. Christison's remarks on latent diseases—directions for discriminating.
3. OF DEATH FROM VIOLENT CAUSES. Explanation of the term *asphyxia*—anatomical changes that accompany it. Whether death arises from suicide.
 - A. OF PERSONS DEAD FROM COLD. Its effects—appearances on dissection. Death from drinking cold water, and its probable cause.
 - B. OF PERSONS DEAD FROM HUNGER. Appearances on dissection in man and animals.
 - C. OF PERSONS DEAD FROM LIGHTNING. Appearances.
 - D. OF PERSONS FOUND BURNT TO DEATH. Effects of burns on the dead and living body. Preternatural combustibility of the human body—cases—theories to explain it.
 - E. OF PERSONS DEAD FROM WOUNDS. Meaning of the word *wound* in legal medicine. Whether the wounds are the result of suicide, accident, or homicide. Wounds from fire-arms—cases. Examination of the skeleton—cases in which murder was detected. Chemical investigations to ascertain the peculiarities in the blood of man and other animals. The hair—footprints.

DEATH, even when it is the consequence of disease, is often an unexpected event. But if an individual expire under his own roof, surrounded by friends and relatives, we are disposed to consider it as an ordinary dispensation of Providence, and

one to which all of us are sooner or later doomed. The features of the case differ materially, when a person is found dead on the highway, on the banks of a river, or in a lonely place. Indeed, if he be discovered to have paid the last debt of mortality, either in a sudden manner or at a distance from his home, the laws of civilized society demand an investigation of the cause, and over this investigation the officer called a coroner is appointed to preside.

The office in question is an important one. The duty of the coroner extends to an examination of the circumstances connected with every case of sudden or suspicious death, and he is to make this with the aid of a jury, summoned by him for the purpose.

The duties of this office are imperfectly understood, and often most negligently performed. The individuals appointed are frequently unfit for the situation, both from habits and education, while the jury are too commonly desirous of hurrying through the investigation. It has been proposed to remedy the first difficulty by selecting coroners from among medical men; and there is no doubt that the administration of criminal justice might be promoted thereby.* Every inquest involves a medical question, and even although the case may at the first glance appear so clear and the facts so certain as hardly to need a professional examination, yet before the trial is ended, there will often be extreme regret that a dissection had not been made.

The medical witness has, however, several obstacles and discouragements to encounter in the performance of his duty. The power of the coroner and his jury to stop him in the progress of his examination is constantly exercised in spite of his remonstrances.† “On a late occasion, one of these grave bodies declared that they would apply to the governors of a London hospital to put a stop to *unnecessary* dissections, and in many cases they have told an inspecting surgeon to stop in the midst of his work, *because they themselves were satisfied*.”‡

Again, compensation is not always allowed to the surgeon

* In England and in this country, medical men have been appointed coroners in many of the large towns and cities.

† [This should always be resisted.—C. R. G.]

‡ Edinburgh Medical and Surgical Journal, vol. xxii. p. 190.

for the dissection, nor to the chemist for his analysis, while he incurs at the same time a high responsibility in deciding on the guilt or innocence of the accused. Certainly no plan could be suggested more effectually to deter all and every medical man from engaging in these thankless investigations.* In my remarks on medical evidence, I shall offer some suggestions for improving this very imperfect portion of our criminal code. At present, conceding that the physician or surgeon is obliged to attend, when summoned at these inquests, I will offer for his consideration some preliminary cautions.

The first is, not to permit sudden prejudice to warp his mind. There is nothing more common among the populace who crowd around the bodies of persons found dead, than to suspect that they have been murdered; and the idea, instead of being judiciously combated, if untrue, is permitted to gain strength by repetition. For charges of this nature the physician should always be prepared, and never allow them to have any influence over him. He should proceed to the examination of the body with a mind free from prejudice. He should recollect that sudden death is not an uncommon event. In addition to this, there are many circumstances which may be the origin of the sudden decease, and to which the person affected has been for a time exposed, without any knowledge of their consequences. Of this nature are the breathing of noxious gases, the use of improper aliments, or of unwholesome water. The passions, also, if highly excited, or a purely accidental cause, may respectively have induced the sudden death. And lastly, the destruction of life may have been caused by the person himself. All these *possible* circumstances should be recollected before a case of this kind is referred to a criminal court on the decision of a physician. It is but a sorry excuse, after a suspected individual has lain for months in a jail on the strength of his opinion, then to come into court and say that he drew

* It has been formally decided both in England and in this country, that the physician should be compensated, but in practice much depends on the coroner or other magistrate. In Pennsylvania, Judge Lewis, in 1844, decided, on general principles, that a *physician has a right to compensation* for making a post-mortem examination at the request of the coroner. (American Journal Med. Sciences, N. S., vol. xii. p. 538.)

wrong inferences from external appearances; or, on the other hand, to meet a brother practitioner who invalidates his opinion, and demonstrates the crudeness and insufficiency of his investigations. The importance of medico-legal dissection is thus inculcated, not only by every sentiment of professional pride, but even by the dictates of common humanity.

In further noticing this subject, I shall consider it under the following general divisions:—

1. OF MEDICO-LEGAL DISSECTION.
2. OF SUDDEN DEATH, FROM NATURAL CAUSES.
3. OF DEATH FROM VIOLENT CAUSES.

The subject of wounds generally, and of poisons, would probably, in perfect strictness, belong to the present title; but as they are very extensive and important in their nature, I prefer considering them in distinct chapters, and this separation will also allow us to notice their effects on the living body.*

I. *Of medico-legal dissection.*

Under this head I propose to give general rules only for the examination of dead bodies applicable to all the cases that may be supposed to occur. Every species of violent death requires an investigation peculiar, in some degree, to itself, and the minutiae of this will be more profitably noticed in succeeding sections and chapters.† I am also to suppose the reader acquainted with ordinary anatomical dissection, and hence may be allowed to omit many things contained in elementary treatises on the science.

* I am obliged, from want of space, to omit a notice of the signs of real and apparent death. Some of them, however, are briefly considered in the next section.

† The following are the principal authorities on this subject: Marc's Translation of Rosa's Manual; Mauchartius' Dissertation in Schlegel, vol. i., and, which indeed anticipates the former in many respects, Chaussier on Medico-Legal Dissection and on Ecchymosis, etc. These two dissertations, which occupy the greater part of his "Recueil de Mémoires," were given, as he states, the one to Dr. Renard, and the other to Dr. Rieux, for their respective inaugural dissertations. Foderé, vol. iii. chapter i.; Mahon, vol. ii. p. 217; Dease's Remarks on Medical Jurisprudence; Paris' Medical Jurisprudence, vol. iii.; Dr. John Gordon, in art. *Anatomy*, Supplement of Encyclopedia Britannica, vol. i.

Before proceeding to the dissection, and particularly if called before the body is removed from the place where it was found, it is proper to notice its situation and attitude, the state of the clothes, and the condition of the ground, whether it bears the marks of footsteps, and their direction. We should remark also whether there are any indications of struggling, or any weapons left in the vicinity.* In our first general survey of the body, the following rules may be observed: 1. If death be apparently caused by a wound, the body should be first viewed, if possible, exactly in the position in which it was found. By moving it, the attitude of the extremities may be altered, or the state of a fracture or a luxation changed, since the internal parts vary in their position with one another according to the general position of the body. If it is absolutely necessary to remove it, it should be done with great caution. 2. The clothes should be removed as far as is necessary, and it should be noted what compresses or bandages (if any) are applied to particular parts. 3. After these preliminaries, we must examine the color of the skin, the temperature of the body,† the rigidity or flexibility of the extremities, the state of the eyes and of the sphincter muscles, noting at the same time whatever swelling, ecchymosis, wound,

* A few illustrations will serve to show the importance of attending to these circumstances. Mr. Jeffries was murdered at Walthamstow, in England, in 1751, by his niece and a servant. Here the perpetrators were suspected to be domestics, from the single circumstance of the dew on the grass surrounding the house not having been disturbed on the morning of the murder, which must have happened, had the murderer left the premises. Mr. Taylor, of Hornsey, was murdered in December, 1818, and his body thrown into the river. No investigation was needed to ascertain whether he had gone alive into the water, as the *hands were found clenched, and contained grass, which, in his struggle, he had torn from the bank.* Again, the marks of footsteps, measured and found to correspond with the shoes of the suspected person, have in more than one instance led to the detection of the guilty. (Paris, vol. iii. pp. 38, 41.)

† It is probably a prevalent opinion that the body, after death, soon acquires the temperature of the surrounding air, particularly if it be lightly covered. This is, however, far from being invariable; and as to the internal organs, Dr. John Davy has shown that they remain for many hours of a higher temperature. See his "Researches Anatomical and Physiological." Dr. Dowler, of New Orleans, has also published some remarkable cases, after death from yellow fever, in which the natural temperature continued for several hours. (Western Journal Med. and Surgery, vol. x. p. 287; Medical Examiner, vol. viii. p. 455.)

ulcer, contusion, fracture, or luxation may be present; also any fluid flowing from the nose, mouth, ears, sexual organs, etc., and indeed everything varying from the natural state. The above cavities should be inspected, and particular attention must be paid to the state of the skin, so as not to mistake that bluish-brown tinge which indicates the commencement of putrefaction for ecchymosis. The distinction between these we shall presently explain.

From the period when the dissector commences until he concludes there should be a clerk at hand to take down all the facts he may from time to time communicate; and this should not be delayed until the examination is completed, as many circumstances of importance may then have escaped his memory.

If there be any external lesion present, it should first be examined, and its nature described; its length, breadth, and depth; also whether it has been inflicted with a cutting, pointed, or round instrument; whether it is accompanied with inflammation or gangrene, and whether any foreign bodies are found in it, such as balls or pieces of cloth. The scalpel should then be employed to trace its extent, but with judgment, so as not to render our researches useless, and to prevent a comparison of the external wound with the internal injury. The nerves and bloodvessels, and particularly the arteries that are wounded, should be named, as should also the viscera, if any are in that state. *If there be a contusion without a solution of continuity*, the injury found in the internal parts should be particularly noticed, such as extravasation, rupture of vessels, etc. *If the cause of death is a burn*, its degree and extent should be examined, together with the state of the parts affected, whether inflamed merely, or covered with blisters; the fluid contained in these blisters, and the condition of the neighboring parts, whether sphacelated or gangrenous. *If a luxation or fracture be present*, notice the surrounding soft parts, the nature of the injury, whether simple or complicated, and the phenomena indicating the progress of disease or of recovery. [In making these examinations, it should never be forgotten that the absence of any marks of external injury by no means proves that very serious (fatal) injuries may not have been inflicted. Rupture of the liver or spleen, fractures of the ribs, &c., may and often have been found

where there was no trace of injury externally. Indeed, Casper goes so far as to assert that he has often, in cases of sudden death, diagnosed the rupture of some important organ, *just because* no trace of injury was found externally. For. Med. Sc., p. 210.]

Having stated all these circumstances, it is next necessary to proceed to the dissection in a systematic manner; and the common rule is to commence with the examination of the abdomen. Chaussier, however, dissuades from this, and advises that it be the last, as putrefaction is there first developed, and the offensive odor may be in a great measure avoided, by previously noticing the other parts. In all our examinations, care must be taken not "*to make wounds while we are examining for them,*" and we must not desist because we suppose that the cause of death is perfectly discovered in one or the other cavity; all of them should be inspected.

[I attended an inquest some years ago, where the cause of a very sudden death, occurring when no person was present, was confidently believed to be disease of the heart, under symptoms of which the patient had labored for years; valvular disease, sufficient in the opinion of all present to cause death, was discovered. Yet on continuing the dissection, prussic acid was found in the stomach, and the case thus proved to be one of suicide.—C. R. G.]

On viewing the head, the integuments, and all injuries done to them, are first to be noticed. In particular, if a wound appears to be inflicted by a sharp-pointed instrument, its depth, direction, and connection with the brain should be minutely traced. The presence of inflammation, cedema, or sphacelus, must be remarked. These observations apply also to injuries from cutting instruments. And in all of these examinations the hair should be previously removed, either by cutting or with a razor. We next proceed to lay the bones of the cranium bare. This is done by an incision from one ear to the other, over the top of the head, and then another transverse to it, from the top of the nose to the occiput. On dissecting these flaps, we shall be able to discover whether any injury has been done to the hard parts. Search is to be made if there be any fractures or fissures, taking care at the same time not

to mistake irregular sutures for them; and for this purpose they should be rubbed over with ink. The strength of these bones is also deserving of minute inspection, as they are not unfrequently so thin or soft as to render a blow, that under ordinary circumstances would only produce slight injury, very destructive. The fracture should always be followed throughout its whole extent.

The skull-cap may now be removed, and this requires to be done with extreme caution, lest we wound the dura mater. Dr. Gordon advises that this should be done by sawing through the outer table, and then breaking through the inner with a chisel and mallet. On the other hand, Renard directs that four holes be made with the trephine at proper distances, and through these openings the cranium separated from the meninges with the handle of a delicate scalpel. The saw is then to be used in the direction of the trepannings, and the skull-cap is readily raised and removed.

This, however, will not suffice in all cases, since many fractures occur in the occipital portions, and at the base of the brain. Here similar careful incisions are necessary, with the proper application of the saw, to discover the extent of the injury.

The membranes and the substance of the brain must now be carefully inspected. Let it be noticed whether any pus or blood is interposed between the dura mater and the bones, or whether it is detached or inflamed. So also of the other membranes, and of the brain itself. All morbid appearances in structure deserve attention, and the state of the blood-vessels, the quantity of fluids present, and their situation, are deserving of attention. It should, however, be remembered, that an extravasation or an injury is not unfrequently found on the side opposite to which the blow was given; and again, that death sometimes follows from blows on the head, when no internal lesion can be found on dissection. It has been abundantly proved that the connection between the brain and the viscera of the thorax and abdomen, is the cause of this, and the injury must in such instances be looked for in the latter.

There are several sources of fallacy in the examination of the brain, which will be presently noticed.

We should not neglect an examination of the base of the brain, since by this, fractures, otherwise scarcely discoverable, have been found. I allude particularly to cases where injury has been inflicted through the orbits of the eyes.*

The vertebral column must be viewed through its whole extent, as to its being fractured, or dislocated, or contused. In any doubtful case it requires strict attention, since injuries of it are often of a very complicated nature. Foderé quotes a case from Jaeger, of a person who was struck on the neck, by a loaded wagon, with such violence that both his upper and lower extremities became paralytic. He died in eighteen hours after the accident. No external appearances of injury could be observed, although an examination readily indicated that the seat of the disease was somewhere near the sixth cervical vertebra, and accordingly, on dissection, its spinous apophysis was found broken at its base and separated from its body, while blood was extravasated to the amount of four ounces. In such and similar cases it may be expedient to remove the whole of the cervical column, which may be done by sawing off the transverse processes, and raising it from its position. All indications of inflammation, or of a want of mobility, should be duly considered.

In examining the neck, Chaussier and Gordon advise us, first, to make an incision from the chin to the sternum, then from the upper point to cut along the margin of the lower jaw to its angle, and from the lower point toward the clavicle. By continuing the dissection, every part may thus be examined in succession. If necessary, the jaw may be removed by a saw.

We should inquire carefully whether the neck bears any marks of external injury, or traces of ecchymosis, or pressure. Examine the great blood-vessels, whether they are filled with blood or empty, and the nerves, whether they are in their natural state. The larynx, trachea, pharynx, and œsophagus, and their contents, must be noticed in succession, removing or reverting the former when we have completed our investigation.

* Paris, vol. iii. p. 51.

If wounded, detail the extent, depth, and shape of the injury, and particularly if the lesion is caused by fire-arms, its course, and the loss of substance, together with the inflammation or suppuration, if any exist.

On proceeding to the thorax, it should first be ascertained whether the injuries it has received are superficial, affecting the integuments and muscles merely, or whether they extend to its cavity. This cannot be determined satisfactorily without an inspection; and for this purpose "an incision is made through the integuments, from the top of the sternum to the pit of the stomach. The flaps are then to be dissected down to the ribs, and backward about an inch and a half beyond the junction of the cartilages with the osseous substance of the ribs. Cut through these cartilages close to their joining, beginning with the second rib and ending with the seventh. Pull forward the lower part of the sternum a little, introduce a scalpel behind it, and detach the diaphragm and mediastinum, then saw through it immediately below the connection of the first rib. The cavity of the chest will thus be sufficiently exposed."

The viscera require very careful examination. The lungs and their internal as well as external condition, the pericardium and its contents, the heart and its great vessels, the thoracic duct,—all should be inspected. Remove the blood with a sponge, so as to ascertain the exact color of the various parts. Particular attention must be paid to the degree of consistence or fluidity of the blood. The importance of these directions will be presently explained.

Lastly, as to the abdominal cavity; its external covering forms a subject of inquiry. Every spot, swelling, or extravasation, should be noticed; as also whether hernia be present, and whether there is any tumefaction of the part. The mode of opening into the cavity needs hardly to be detailed. A crucial incision may be made, and if this be not sufficient, the pubal bones on each side may be removed with the saw. The condition of the peritoneum then requires attention, and the presence or absence of fluid in the cavity. The organs peculiar to either sex should be examined, and also the various viscera—the stomach, mesentery, liver, spleen, gall-bladder, intestines, bladder, etc. etc. We should view each part as to the quantity of

blood which naturally belongs to it, trace all extravasations as to their quantity and nature, and particularly inquire whether the changes observed are the result of disease or of sudden injury. Professor Mahon recommends the use of a blunt-pointed bistoury in examining the intestines, as this may prevent injury during the dissection.

Although I shall have occasion hereafter to notice the subject in detail, I must not omit to remark, that if there be any suspicion of poisoning, the whole of the alimentary canal, from the œsophagus to the rectum, should be carefully removed for further inspection. Dr. Gordon's directions may be followed for this purpose. He advises that a double ligature be applied at the very commencement of the jejunum, and the intestine divided between the two threads; a similar ligature is then to be applied to the ileum, close to its termination in the colon, and the tube divided in the same manner. The root of the mesentery being now cut through, the whole jejunum and ileum are removed together. A double ligature is next to be applied to the rectum, as low down as possible, and being divided between the cords, it is to be removed with the whole of the colon. The œsophagus, stomach, and duodenum, are then to be extracted together, taking care previously to tie a ligature round the top of the œsophagus.

The mode of conducting the analysis of the contents of these parts will find a place under the head of Poisons.*

The above remarks do not apply exclusively to the stomach. If any viscus appears to require a more strict investigation than can be given to it *in situ*, it should be removed from the body after the general dissection; and I may add, that it is often of extreme importance to preserve those parts on the appearance of which our evidence is founded. Thus, in cases of supposed poisoning, the stomach and duodenum may be preserved in alcohol to meet any conflicting testimony, or to elucidate doubts; and Dr. Paris has well illustrated the value of this advice in its

* How necessary it is to be very cleanly in these operations, is illustrated by the observations of Renard, (p. 116,) who states that in one instance the stomach was negligently laid on some white sand. At the subsequent examination, particles of this were found, and gave rise to an idea of poison by means of powdered glass.

full extent, by referring to the preservation of the uterus in the case of Miss Burns.

Having completed the dissection, the notes taken should be reduced to order; and in preparing the report, or in giving testimony, it should be as plain and simple as possible, avoiding all those terms which are unintelligible to a court and jury.

It is evident even, from the brief notice that I have now given, how necessary an accurate knowledge of anatomy is in these doubtful cases, and how important it is not to mistake natural appearances for extraordinary occurrences, or the effects of disease or death for those of violence. The ignorant are ever making mistakes on these points, and we should be prepared to encounter them. A notice of the more common mistakes will form a proper commentary on what has been said, in order to establish such distinctions as may be applicable in these investigations.

Hemorrhage is supposed by many to indicate the existence of the circulation when it commenced; and accordingly they deem its occurrence as *prima facie* evidence that life was present when the supposed violence was offered. Such an opinion, however, if adopted universally, must lead to dangerous errors.

Hemorrhage is of itself no proof that a lesion has been inflicted on the living one. Still, the medical examiner must pursue the investigation in as minute a manner as possible, and particularly so when the hemorrhage is internal. If effusions of blood are observed in the thoracic or abdominal cavities, all the blood-vessels should be looked to. A wound may be found in one of the smaller ones, or a rupture in the larger, and thus the cause and its occurrence during life are at once established.

But hemorrhage may be wanting, and on dissection the blood found fluid in the heart and its large vessels, the spinal canal, the lungs, or the brain. *Is this to be deemed a proof of violent death?* Certainly not. Fluidity is most common in such cases, as from narcotic poisons, lightning, and the like; but it is also observed in sudden death from ordinary causes, and particularly in apoplexy, and occasionally in the usual forms of disease that come under the observation of the anatomist.* The

* For an interesting discussion of this subject, in which many of the lead-

reason of this diversity we cannot explain, but the fact is undoubted. "Although vital effusions," says Professor Christison, "are usually coagulated, they are not so always." On the other hand, "where blood flows from a body after death, or where a wound has been made after death, the blood is never found in a state of coagulation."*

Mr. Paget, in his observations on the "coagulation of the blood after death," makes it appear that the separation of the parts of the blood goes on very much as it does with blood drawn in a basin. He advises particular attention to the condition of the coagula as illustrating the position of the body for some hours after death. In an individual who remained in the sitting posture three hours after death, there was less separation in the auricles than in the superior cava, etc. The reverse occurs in the recumbent posture, as gravitation manifestly operates.†

What I have now stated concerning blood and its effusion, will better enable us to discriminate between divers appearances that are frequently noticed on the dead body, and which are liable to be confounded. They have various names attached to them, according as they are supposed to originate from different causes; and with an explanation of these I shall introduce this intricate but important point.

The term *contusion* is derived from the Latin word *contundere*, to bruise or pound; and hence conveys a similar meaning. *Ecchymosis* is a Greek term, and is equivalent to effusion or spreading of blood into the cellular tissue. It is present whenever the contusion is sufficiently violent to rupture a

ing men in London took part, see *Lancet*, N. S., vol. iv. pp. 48 and 84. See, also, an elaborate paper by Mr. John Davy, *Edinburgh Med. and Surg. Journal*, vol. li. p. 370.

* Paris, vol. iii. p. 31. "It may not always be easy to distinguish internal hemorrhage, according as it occurs before or after death." The most discriminating circumstances, according to Christison, whom I now quote, are the marks of compression on any organ within the cavity; the extent of the hemorrhage; the coagulation of the blood; and particularly the rupture of an artery, with its correspondent effects. All these indicate that it has happened during life. (*Edinburgh Medical and Surgical Journal*, vol. xxxi. p. 250.)

† *London Med. Gazette*, vol. xxvii. p. 613.

blood-vessel; and the natural result is to communicate a color more or less livid to the skin, which sometimes extends to a considerable distance beyond the seat of the injury, depending in a great measure on the nature of the surrounding tissues. When the quantity of blood is sufficiently large to produce a tumor or swelling of any magnitude, it is called a *thrombus*.

These various states are deemed to indicate the existence of life when they occurred. Ecchymosis is a subcutaneous hemorrhage, generally arising from external causes, although it may also from strictly internal ones, as coughing, vomiting, efforts at stool, etc.; and its course is gradually to diminish in intensity of color at its circumference, retaining the livid appearance longest at the centre. The shades produced by the gradual absorption of the blood are familiar to all medical men, and they serve to show the distinction between livid spots occasionally noticed during life, and which are uniform in color throughout their whole extent.*

* This subject has been illustrated by an able Memoir of Dr. H. Bayard (*Annales d'Hygiène*, October, 1843) on the diagnostic character of ecchymoses. He divides them into two forms, as follows:—

Traumatic ecchymoses, 1. Are the result of external causes. 2. They have at times a considerable extent, but generally exist in only one place. 3. Tumefaction, more or less apparent, often elastic and presenting a shining appearance, attends them, and a change in the coloration of the part soon takes place. At first the color is livid or lead-colored, but it becomes violet or reddish. 4. In these ecchymoses the coloration is most intense at the centre. 5. The temperature of the part is above that of the surrounding surface. 6. The blood generally coagulates, but when effused in large quantity it does not, but gives rise to the formation of abscesses. 7. The seat of the effusion is quite indeterminate and accidental. 8. The capillary vessels are ruptured; the coloration of the vessels disappears on maceration. 9. The coincidence of illness or general disorder of the system is quite accidental. 10. The hemorrhage of the mucous membranes is the result of accidental causes.

Spontaneous ecchymoses, 1. Are the effect of internal causes. 2. Are limited to a small space, but then the spots are numerous. 3. Generally exist without any tumefaction; the blackish tint changes little and only slowly disappears. The color is generally brown, or like the lees of wine. 4. In these ecchymoses the shade of color is uniform over all the spot. 5. The temperature is the same as that of the sound parts. 6. Blood is only effused in small quantity and remains fluid. 7. General ecchymoses are observed over the whole body; local ecchymoses generally occur in the limbs, and especially on the lower extremities. 8. The capillary vessels are not ruptured in general; the coloration of the tissue does not disappear on maceration. 9. A

If this, then, be recognized as the effects of injury, whether intentional or accidental, *during life*, it remains to designate the post-mortem appearances that may be mistaken for it. For them the term *suggillation* has been proposed by Belloc and others, and although objected to by Chaussier, may serve in the place of a better. It is applied to those livid spots of various sizes which are noticed on the bodies of the dead, generally after they become stiff and cold. They are seen on depending parts, as the back and loins, but occur also on the neck, head, and genitals. They are of a uniform color, and, according to Chaussier and Renard, consist in a *congestion of blood in the capillary tissue alone, and not extending to the subcutaneous*. This can be proved by cutting into them; and Dr. Paris proposes, as these discolorations are often mistaken for signs of violence, to prevent the possibility of dispute, "that a layer of the skin, where such lividness is present, be removed, to show that it is confined to this organ, and is not attended with infiltration of blood into the cellular membrane."*

This livid appearance now, described under the name of *suggillation*, is to be ascribed to the effects of gravitation. The blood obeys physical laws in the dead body, and hence it is found in the most depending situations, as the back of the body, and the posterior portion of the lungs. So well is this established, that if the body be reversed and placed with its face downward, the lividity will change places and occupy the front part of the body. Dr. Beatty indeed states that he has seen the lividity already formed on the back disappear, when the body was turned, before it became cold.†

disease, or general illness, or organic disease, almost always precedes, and is the cause of spontaneous ecchymoses. 10. The mucous membranes are frequently the seat of spontaneous hemorrhages.

* Chaussier, pp. 385-430; Belloc, p. 315; Rieux, p. 251; Renard, p. 86; Paris, vol. iii. p. 104. I have thought myself justified in somewhat varying the definition of *suggillation*, as given by Belloc.

† Cyclopedia of Practical Medicine, vol. iii. p. 321, art. *Persons found dead*. The reader must not suppose that this *lividity* occurs in every case. The skin is often remarkably pale, even in the depending parts when death has originated from hemorrhage, either accidental or by violence. An instance of this description is related by Devergie, vol. i. p. 82, in an individual who cut his throat with a razor.

Sometimes, also, either from the pressure of the clothes, or from the inequality of the ground on which the dead body has lain, the suggillation is not uniform in color or regular in appearance. White lines, of greater or less extent, have in consequence been found traversing it.

It is an illustration of the acuteness of Zacchias that he should propose, in the infancy of the science, the following as a discriminating mark between ecchymosis and suggillation: When the discoloration is the effect of external violence, a congestion of thick *concrete* blood will be found; but in the spontaneous spot, the blood, on incision, will be seen *fluid*.

We are not, however, to imagine that the blood in every case is confined to the capillary tissue. With the progress of putrefaction, the fluid blood collects in the more lax and distensible parts of the subcutaneous tissue, as the loins, scrotum, etc. This pseudo-ecchymosis is, however, uniform in its color, and explains its doubtful points by its situation and the progress of decomposition.*

Probably the most puzzling cases will be those in which severe epidemics, as petechial fevers or smallpox, have been the cause of death, while suspicions of violence are at the same time excited. The system here is, during the last stage of life, verging to putrefaction, and extravasated blood of considerable consistence is not unfrequently found.†

Belloc relates an instructive case which came within his own observation. During the prevalence of an epidemic smallpox, a husband maltreated his wife, who was five months advanced in pregnancy. He gave her several kicks on the thighs and abdomen. A week afterwards she was seized with the smallpox, and died in a fortnight after the injury, covered with dark-colored spots, and also with marks of the disease. In this condition she was buried, but her relatives, hearing of the ill treatment she had received, complained of the husband, and the body was accordingly disinterred and examined by physicians. They decided, both from the symptoms present during her illness,

* Orfila's *Leçons*, second edition, vol. ii. p. 238.

† Mahon, vol. ii. p. 210, who quotes, in illustration, some dissections of Stoll.

such as violent hemorrhage from the nose, and from the appearances observed on bodies dead from this epidemic, that the cause of death was the smallpox, and that the suggillations were the consequences of its malignity.*

Rieux, in the conclusion of his remarks on this subject, proposes the question, whether contusions, and their consequence, ecchymosis, can be produced on the dead body? The inquiry is important, not only from the possibility that injury may be inflicted on a corpse for the purpose of implicating an innocent person, but particularly from the rough treatment that bodies brought to the dissecting-room often receive. We should at least understand whether these have been subjected to violence during life.

Our author does little towards solving the case. If the blows (he observes) have been given shortly after death, when the body is still warm, the blood fluid, and the muscles retain their contractility, some difficulty may be experienced in discriminating; but even here, he adds, there will be no tumefaction, no infiltration, and the blood issuing from the lacerated orifices will remain fluid.†

Dr. Christison, however, in some investigations consequent on the murders by Burke and his accomplices at Edinburgh, has materially added to our knowledge. The spine of the murdered female, Margery Campbell, was ruptured in several of its ligaments, and a mass of thick, black semi-fluid blood was collected on the sheath. There was, in several parts of the

* Belloc, p. 317. See also, Bose, *de suggillatione in foro cautè dijudicanda*, in Schlegel, vol. iv. p. 67. The following case may be read with profit by all medical men: "John Stringer was tried at the Lent assizes, held at Kingston, in the County of Surrey, in the year 1765, before the late Chief Baron Smythe, for the murder of his wife, and found guilty. It appeared that they had frequently quarrelled, and a young surgeon gave it as his opinion that some appearances in the corpse were somewhat the appearances of a mortification occasioned by bruises. Mr. Carsan, an eminent surgeon in the neighborhood, had, on the report of the murder, from mere curiosity, examined the body, and it was so clear that there were no marks of violence thereon that he had not the least apprehension of the possibility of Stringer's being convicted; but hearing of it, he stated the case to the Archbishop of Canterbury, obtained a respite from Baron Smythe, and finally was the means of obtaining a complete pardon from the king." (Phillips' Law of Evidence. Appendix, p. 105.)

† Rieux, p. 272; Chaussier, p. 470.

body, effusion of semi-fluid blood, but not indicated by any external mark. Having good reason to believe that some of these injuries, and particularly that to the spine, had been inflicted after death, he was led to ascertain, by experiment, the effect of blows on the dead body, within a few hours after life had departed.

The conclusions deduced from these are the following: "For some hours after death blows will cause appearances which in point of color do not differ from the effects of blows inflicted recently before death. The discoloration, like lividity or suffilation, generally arises from an effusion of the thinnest possible layer of the fluid part of the blood on the outer surface of the true skin, but sometimes also from an effusion of thin blood into a perceptible stratum of the true skin itself. Dark fluid blood may even be effused into the subcutaneous cellular tissue in the seat of the discolorations, so as to blacken or redden the membranous partitions of the adipose cells, but this last effusion is never extensive."

Thus, *severe blows inflicted very shortly after death will exactly imitate slight contusions inflicted during life.* It is evident that the blows producing the last must be trivial.

When the blow during life is more severe, it leaves several effects not to be found on the dead subject; such as swelling from the extent of the extravasation; a yellow margin round the black mark;* effusion of blood into the cellular tissue, and an incorporation of blood with the whole true skin, rendering it black, and increasing its firmness and resistance. It is possible that clots of blood might occur from lacerating a considerable vessel in the neighborhood of loose cellular tissue; but this he had never noticed on the dead body.

Even the inconsiderable appearances of injury first noticed could only be produced within about three hours after death. As soon as the body became cold, and the muscles acquired rigidity, contusions could hardly be imitated.

Internal hemorrhage, from the laceration of a considerable blood-vessel, and more especially of a vein, may be produced

* On this Dr. Chowne remarks: "I am disposed, however, to consider that the yellow margin round the black mark does not so much indicate the severity of the blow, as the time at which it was inflicted."

by violence on the dead body. And the fluid portion will have a tendency to collect in the lowest part.

Another fact noticed by observers, and corroborated by Dr. Christison, is that the blood will remain fluid in some parts, as in the vessels within the head and spine, while it coagulates in others.*

Contusion without ecchymosis, i. e. without rupture of the capillary vessels, must generally be deemed unimportant, unless we include (with Devergie) under this head the effects of compression with a cord, handkerchief, etc. The result, in these instances, is a removal of the fluids from the parts compressed, a condensation of the skin and cellular tissue, and a hardened, yellowish state of the former, resembling parchment. This is often seen in the neck in cases of hanging and strangulation, and will be more particularly noticed in the sections on these modes of death, but it may occur in any part that is not fleshy, and where the pressure is resisted by the bones. It is important to add, that it can be produced on the recently dead as well as on the living.†

Sanguineous congestions are often found in persons who have been subject to disease. They may also be the effect of violence. And in addition to this, they may be formed after death. The texture of the organs themselves becomes affected by transudation of blood, and this is particularly seen in the brain, heart, lungs, stomach, and veins. To distinguish these appearances they have been styled *pseudo-morbid*. I must preclude myself from going into detail concerning them.‡ The most important changes thus induced, in reference to legal

* Edinburgh Medical and Surgical Journal, vol. xxxi. p. 244. The following authors on Ecchymosis, etc., are worthy of consultation. Chaussier, Renard, and Rullier, in the Dictionnaire des Sciences Médicales. "Christison," says Professor Channing, in a letter to the author, "in his admirable paper on the effects of blows after death, says that he has known the blood coagulate firmly *eight hours* after death. I have seen the blood coagulate firmly as it flowed in a post-mortem examination, in one case twelve hours after death, and in another upwards of thirty hours after."

† Devergie, vol. ii. p. 54.

‡ The exact period after death at which the dissection is commenced should always be stated. If prolonged for twenty-four hours or more, many pseudo-morbid appearances may be mistaken for lesions. Magendie on the Blood. (Lancet, N. S., vol. xxiii. p. 826.)

medicine, are those of the stomach and intestines, and these I shall hereafter have occasion to notice.

It would appear that they can be artificially imitated. Thus Chaussier, by injecting ink into the veins, found it to tinge the neighboring organs within a short time.* So also with blood introduced after death. It is important not to mistake these alterations for gangrene.†

Mr. Hodgson, in a paper read before the British Association in 1839, "On the red appearance of the internal coat of arteries," remarked that this was far from always depending on inflammation, and that it was found in subjects of all ages, and in healthy as well as morbid coats. He related the experiments of Laennec and Andral, which proved that this red appearance might be communicated after death, by immersing the vessels in blood. As to the efficient cause, he stated that it might proceed from imbibition. When dependent on inflammation, it will be found affecting the inner coat only; but when on other causes, it will often pervade the elastic or middle coat as well as the serous.‡

* Page 230.

† The following are important authorities on this subject: Chaussier, pp. 244, 269. Dr. Yelloly, on the vascular appearance of the stomach, which is frequently mistaken for inflammation of that organ, in *Medico-Chirurgical Transactions*, vol. iv. Rigot and Trousseau on the changes that take place after death in the appearance of the blood-vessels, lungs, etc., in *Edinburgh Medical and Surgical Journal*, vol. xxviii. p. 149; Andral's *Pathological Anatomy*, vol. i. p. 43. He divides hyperæmia (or preternatural accumulation of blood in the capillary vessels) produced after death into three species: from dependent position, from transudation of the blood or some of its component parts, and from chemical affinities. *Cyclopedia of Practical Medicine*, vol. iii., art. *Pseudo-morbid appearances*, by Dr. Todd. Cruveilhier lays it down that all uniform redness, without vascular injection or dotting, is cadaverical.

Clinical Lectures on Pseudo-morbid appearances, by Dr. Chowne, in *Lancet*, vol. ii. for 1838-1839. Dr. Patterson on Pseudo-morbid appearances of the brain. *Edinburgh Med. and Surg. Journal*, vol. lvii. p. 106.

Prof. Channing, of Harvard University, has been kind enough to mention to me the following case: "A man died at the hospital so calmly that those about him hardly knew of the event. I saw around his right wrist a broad discolored circle, deeply livid as if it had been violently beaten. I called the attention of the students to this case, and begged them to observe, that here, quite round the wrist, was a mark that might most easily, and, as we say, naturally have been taken for violence during life."

‡ London Athenæum, 1839, p. 706.

In hot climates, and in the warm season in our own country, the progress of this change is proportionably rapid. Thus Dr. John Davy, at Ceylon, found that if the interval between death and the examination was twenty or thirty hours, the serous and mucous membranes appeared red and inflamed, and particularly those parts which are most exposed to the action of the blood, as the valves and the lining membrane of the heart and blood-vessels. The viscera also were dark and livid. He attributes this to the exudation of bloody serum tinging the parts.*

The presence or the quantity of serum must be considered with reference to the remarks already made. Magendie has shown that a certain portion is natural to the brain, and we shall hardly be safe in drawing unfavorable inferences from its accumulation. The same remark applies to what are deemed appearances of inflammation in the head and lungs. The membranes are to be examined more in reference to any change of structure that they may have undergone, than as to redness or congestion. So also with the heart.†

* Medico-Chirurgical Transactions, vol. x. p. 89. The lungs, as I have already intimated, are often gorged, and in most instances this occurrence can be explained on the principles now laid down. If, however, the lower part be peculiarly congested, while the body has lain in its usual position on the back, does it not indicate that the body has been for some time in an erect posture, and may it not have arisen from violence, as suspension by the neck? (Chaussier, p. 83; Renard, p. 109.)

† Some useful remarks on the examination of the head may be found in Shaw's Manual of Anatomy, vol. i. See also Andral on the Serous Fluid, vol. i. p. 235. The following extract from Lizars deserves to be remembered: "The cavity which first ceases to contract, at death, is the left ventricle; secondly, the left auricle; thirdly, the right ventricle; and lastly, the right auricle, which continues the longest to vibrate. Hence when the heart is laid open, very little blood is found on the left side, while it is accumulated on the right." (Anatomical Descriptions, p. 144.)

I also add the following as worthy of constant remembrance:—

State of the Arteries and Veins after Death.—The fact of the arteries being found empty after death, except under very peculiar circumstances, has been known from the earliest times. It has also been long known that general capillary congestion is one of the first symptoms of decomposition after death. The skin becomes suggillated with red streaks, the conjunctiva is bloodshot, and the mucous membrane livid. If the interior of the body is examined, the venous capillaries are everywhere found gorged with blood. The fluid contained in the serous cavities also become tinged with blood, and the larger veins are empty *as well as* the arteries. M. Devergie, in his work on Legal

Wounds, accompanied with a solution of continuity, if received before death, are marked by red, bloody, and separated edges. Blood is also more or less collected in the cellular tissue: while those inflicted afterwards are livid, and their edges close to each other. It would, however, seem, from the experiments of Orfila, that a wound inflicted with a cutting instrument *immediately after* death, is with difficulty discriminated.*

Mr. Wallace, of Dublin, also observes, that in three cases of instant death from wounds of the heart, all the above signs were wanting. There was no external hemorrhage; but there was an internal effusion of blood into the pleura and an emphysematous infiltration of the cellular tissue, "neither of which appearances could, in all probability, have taken place, if the wound had been inflicted after death." There was also more blood effused into the pericardium than could by any possibility have been poured into it by a wound inflicted after death.†

We are also informed that when a patient dies during the progress of a wound, it exhibits some remarkable appearances after death. "The edges, as well as the granulations, sink; they become pale, and the commencement of cicatrization does not appear distinct from the other parts of the wound, so that

Medicine, (vol. i. pp. 166, 214,) accounts for these anatomical appearances, by the decomposition of the fluids, the gases developed in the blood-vessels propelling that fluid into the capillaries. M. Devergie's interpretation of the above phenomena is generally adopted by the French medico-legists. (Lancet, April 13, 1844.)

* Orfila's *Leçons*, second edition, vol. ii. p. 540.

† Lancet, N. S., vol. xiv. p. 144. Mr. Taylor made a simple incised wound in the calf of the leg *two minutes* after its removal from the body by amputation. The skin retracted, and there was but little hemorrhage. At the expiration of twenty-four hours, the edges were seen red, bloody, and everted, but the skin was merely somewhat flaccid, and not in the least degree tumefied: at the bottom of the wound was found a small quantity of very loose coagulated blood. In a second experiment, made *ten minutes* after the amputation, the skin appeared to have lost its elasticity, as the edges of the wound became but very slightly everted, and scarcely any blood escaped. On examination, twenty-four hours afterwards, the edges were seen pale and perfectly collapsed. Still at the bottom of the wound there were a few coagula. Lastly, when the incised wound was made two or three hours after the removal of the limb, although a small quantity of liquid blood was effused, no coagula were found. In the case of a wound made twenty-four hours after death, the edges were yielding, inelastic, and in close approximation. (Med. Jurisprudence, p. 276.)

it is more difficult to form an opinion as to the age of the wound after death than during life.”*

[This rule is stated too absolutely. Casper found in the body of a man, who died ten minutes after being run over, “the seventh and eighth ribs of the left side fractured, without any trace of effusion of blood, and perfectly resembling a fracture produced after death. For. Med., vol. i. p. 110.—C. R. G.]

“The question whether there has been a *fracture* of the cranium previous to death is sometimes more difficult to decide than a person who is not accustomed to make dissections would imagine. If the fracture has occurred immediately before the patient’s death, there will be coagulated blood found upon the bones and in the fissures; if the patient has survived for some time, there will be marks of inflammation, and perhaps pus, in contact with the skull; but if a fracture has been produced in making the examination (which sometimes happens in even very careful dissectors’ hands), the blood in the fracture will not be coagulated, nor will there be any effusions around the portions.”†

[The following observations by Casper are important, giving as they do the results of a very uncommonly large number of experiments he has had the opportunity to make, and which he still repeats every academic session: “It is extremely difficult to break up the organic cohesion of dead organs. I refer not to stabs or cuts, but to fractures of the bones and rupture of the internal organs. Numerous and uniformly consonant experiments enable us to establish this dogma: When from any cause, such as complete putrefaction, it is no longer possible to ascertain whether the injuries discovered in a body have been inflicted before or after death, the existence of considerable injuries of the cranial bones, particularly of the solid bones of the basis crania, establishes at least the utmost probability that the injury has been inflicted during life, unless there be proof that some extraordinary violence has been inflicted on the body. All the long bones of the extremities have after death the same extraordinary power of resistance. The ribs are more easily fractured, but the fracture is always transverse, and never splintered. I have never succeeded in fracturing the larynx or os

* Watson on Homicide, p. 21. .

† Shaw’s Manual, vol. i. p. 45.

hyoides in an adult, and have therefore no hesitation in laying down this dogma: An existing fracture of either of these parts must have been produced before death."—C. R. G.]

Mr. Alcock, some years since, stated in a public lecture at London, that he had known a fracture of the base of the skull produced by the awkward and violent tearing of the upper portion, the saw not penetrating deep enough to divide the bones, and this was mistaken by the inexperienced operator for fracture of the skull producing death. Being a medico-legal case, it might have led to melancholy consequences had not the error been detected by an observer.

The following remarks are copied from Dr. Godman: "We frequently find the bones of subjects brought for dissection singularly fractured; sometimes the skull is broken and depressed, or the pelvic junctions separated, with other injuries of a similar character. These, if found on a body submitted for medico-legal investigation, would be readily enough attributed to violence done previous to death. Perhaps the best mode of deciding in these cases will be to examine the muscles, which are usually broken in the dead subject at the same time with the bone, and exhibit no effusions of blood, whereas it would be found in quantity, if the injury preceded death."*

I may now conclude this portion of my subject with the following narrative, as illustrative of the difficulties that attend it and the caution that is required:—

The widow Montbailly, of St. Omers, aged sixty, and of a very gross habit, was inebriated daily. On the 27th of July, 1770, at 7 A. M., she was found dead in her chamber, lying on a trunk which had sharp edges. A physician and surgeon visited the body on the next day (thirty-two hours after her death had been discovered), and reported that they found ecchymosis and contusions on the arms, thorax, and particularly over the third, fourth, and fifth ribs. The neck and upper part of the breast were also ecchymosed. The head was swelled, blood was extravasated under the skin of the face, and the nose was filled with clotted blood. On the eyelid there was a wound of nine or ten lines in extent, which penetrated to the orbit, and might have been caused by a sharp or cutting instrument, but

* Physiological Investigations.

could not, in their opinion, have produced sudden death. On opening the body, all the internal parts were found in a natural state, except the brain, which was not examined.

The reporters gave it as their opinion that the ecchymosis, the swelling of the head, and the extravasated blood, were occasioned either by a fall, or by blows, and that the female had died either from the hemorrhage occasioned by the wound, or from suffocation.

A physician who, from curiosity, had attended the examination, but who was not of the commission, stated that the eye was ecchymosed, and that the edges of the wound were irregular and indented.

On combining the results of this inspection with the fact that the defunct had formerly repeated quarrels with her son and daughter-in-law, it became the prevailing opinion that they had murdered her. The superior court of Arras, before which the cause was tried, condemned Montbailly and his wife to be broken on the wheel, and it was actually executed upon him. The wife claimed a delay on account of her pregnancy, which was granted. During this interval, a revision of the trial was procured, and the celebrated Louis was consulted as to the point whether the facts stated proved that the woman had been assassinated. The result of his investigation was, that there was no certain proof of the commission of murder, and that all the circumstances enumerated were stronger proofs of the individual having died from apoplexy, than from any other cause. The following are some of his reasonings and remarks:—

Intemperance predisposes to sanguineous apoplexy, and the reporters have neglected their duty in not opening the head of the deceased, since by doing so, the condition of the internal parts would have explained the cause of the hemorrhage. Again, a person in a state of intoxication, and predisposed to this complaint, would, on falling against any sharp-edged substance, naturally lose a considerable quantity of blood, and also have the arteries and veins of the head much distended. He totally discards the idea that the hemorrhage from the wound of the eye was a cause of death.

As to the ecchymosis or livid spots found on the thorax

and arms of the deceased, and which the reporters attributed to blows or falls, M. Louis observes that they are the ordinary appearances found on those who die in a state of intoxication, and, among others, quotes the following case in confirmation, from Morgagni: A beggar went to bed drunk, and died suddenly during the night. This was at the end of January, 1746. On the next evening he was carried to the anatomical hall in Padua, and on the third day after his death he was dissected. Morgagni found the body still warm. The scrotum was ecchy-mosed, of a red color, the face filled with blood, not only under the skin, but all the muscles, the membrane that separated them, and the glands, appeared engorged. Louis remarks that these spots should have been particularly examined, in order to have founded any charge upon them.

It appeared further, that the body was examined at the end of the month of July. Might there not have been some incipient putrefaction present, and would not this account for the swelling of the head, the lividness of the thorax, and other similar symptoms? As to the wound in the eye, the reporters themselves leave its effect uncertain, while the cause might have been accidental.

On these grounds, Louis gave it as his opinion that the report was inconclusive, and that there were no proofs of assassination.

The superior court of Arras accordingly, in 1772, revoked their decision, exonerated the memory of Montbailly, and enjoined the physicians and surgeons thereafter to extend the examinations to every part of the bodies of those found dead, and also to state in their reports the scientific reasons for all opinions they might give.*

* Foderè, vol. iii. p. 64, from the *Causes Célèbres*. See also, at page 98 a similar case from the same, *Cause de Chassignieuz*.

The following case I find mentioned in the lectures of the late Mr. Ashmun, Professor of Law at Harvard University. Those relating to medical jurisprudence are in course of publication in the *American Jurist*:—

On board a ship coming from Calcutta, there had been a disturbance, and one of the sailors was said to have received a blow in the side from a hand-spike. The evidence was discordant as to his condition subsequent to this. Four months, however, after, and when he had been in port several days, and was freely on shore, he one day ate a large dinner and drank freely.

It will readily occur to the reader, that the preceding observations are incomplete, unless some notice be taken of the SKELETON. Its examination is often necessary, either as a whole or in part, and this, both from the decay of the soft parts and the period that may have elapsed since death. It is highly necessary to be familiar with the variations induced by *age* and *sex*. In children the bones have a larger portion of gelatine: in youth this and the earthy matter are probably equal, while in old age, the phosphate of lime greatly predominates. This explains the obliteration of sutures and the absorption of the alveolar processes. The following table, taken from the memoir

He was taken ill, and a physician was sent for, but he died before any aid could be administered.

An examination took place. The stomach was highly inflamed, and still retained the food of the previous day. The liver was much diseased, and there were numerous abscesses in it. The gall-bladder was natural. The fifth and sixth ribs were found to have been fractured so near the sternum as to occasion a slight depression of it; but the bones were so entirely united as to give no indication of the age of the fractures. The heart and lungs were sound.

On these appearances, the medical examiner gave it as his opinion that there was a probability that the *fracture of the ribs had produced the diseased appearance of the liver*, and that the influence of the latter had extended to the stomach. The persons accused of injuring the deceased were on this testimony committed by a justice of the peace to take their trial for murder.

They were, however, soon brought up again on a writ of habeas corpus before two judges of the supreme court of Massachusetts, and in the mean while the Professor of Anatomy in Harvard University had made a further examination of the disinterred body. The stomach was found to contain a quart of undigested food, mixed with gin. Its internal surface was highly inflamed, and particularly at the cardiac orifice. There were four or five ounces of water in the pericardium. In the liver were several tubercles, one of which had suppurated, but it had no connection with the fractured ribs. Indeed, the "liver was so situated that it could not have been wounded by the fractured ribs without penetrating the diaphragm and the lower part of the lungs." Yet these parts were sound.

The blood-vessels of the heart were highly congested, the ventricles contained much serum, and there was a general dropsical effusion throughout the body.

No other opinion could be given than that the present was a case of general disease, induced by intemperance, and that the immediate cause of death was the overloaded state of the stomach. The prisoners were in consequence discharged. (*American Jurist*, vol. xiv. p. 20.)

of Sue,* will serve in determining the *mean proportions* of the skeleton at various *ages*:—

A child one year old measures in length one foot 10½ inches; length of the trunk, (from the vertex to the symphysis pubis,) 13 inches 6 lines; of the superior extremities, (from the edge of the acromion to the extremity of the fingers,) 9 inches; and of the inferior extremities, (from the symphysis pubis to the soles of the feet,) 9 inches.

	Length of trunk.	Sup. extr.	Inf. extr.
Child of 3 years...2 ft. 9 inches,	19 inches,	14 inches,	14 inches.
Child of 10 years...3 ft. 8 in. 6 lines,	2 feet,	1 ft. 7 in.,	1 ft. 8 in. 6 l.
14 years.....4 ft. 7 inches,	2 ft. 4 in.,	2 ft. 6 lines,	2 ft. 3 in.
20 to 25 years.....5 ft. 4 inches,	2 ft. 8 in.,	2 ft. 6 in.,	2 ft. 8 in.

After the last age, subjects present no variation in their proportions.

Dr. Gordon, of Edinburgh, on the other hand, assuming the mean stature of the male, at the time of maturity, to be five feet eight inches, English measure, gives the following measurements:—

	Inches.
From the crown of the head to the top of the pubes.....	34·00
From the crown of the head to the lower margin of the chin.....	9·75
From the lower margin of the chin to the top of the breast.....	3·85
From the top of the breast to the pit of the stomach.....	6·08
From the pit of the stomach to the navel.....	6·08
From the navel to the top of the pubes.....	6·08
From the top of the prominence of the shoulder to the fold of the elbow	12·06
From the fold of the elbow to the top of the hand.....	10·02
The hand measured in the palm, from the lower fold of the wrist to the point of the middle finger.....	7·75
From the top of the inside of the thigh to the inside of the joint of the knee.....	14·06
From the last to the sole of the foot.....	18·05
The foot measured on the sole, from the posterior margin of the heel to the point of the great toe.....	9·75

The average height of the female he considers to be about five feet five inches, and, of course, the length of the different regions is proportionably less.†

It is very important to remember that the height of a skeleton is less than that of the individual during life by about one inch; as, for example, a person measuring 5 feet 8 inches, his skeleton will be 5 feet 7 inches. The weight of a skeleton of

* Quoted by Orfila, *Leçons*, vol. i. p. 79.

† Supplement to the *Encyclopedia Britannica*, vol. i. p. 255.

a middle-sized adult ranges between 160 and 200 ounces, and that of the female a little lower, from 100 to 150 ounces.*

In none of the osseous parts is the distinction between the *sexes* more marked than in the pelvis. No less than six differences are pointed out by Dr. Blundell. "In the male, there is a certain roughness, and bulkiness, and weight, which strikingly contrast with the lighter, and smoother, and more elegant pelvis of the female. In the male pelvis, the ilia or wings of the ossa innominata are more erect; in the female, more expanded. In the male, the brim is more rounded, though somewhat tending to an ellipse, the long diameter of which stretches from before backward; in the female, the brim, though somewhat rounded, is generally oval, and the long diameter lies between the sides. The male pelvis is deep, the female shallow; the male outlet is very small, the female very capacious. Lastly, in the male, the arch of the pubis is contracted; in the female it is capacious, to make room for the ready passage of the head."†

With regard to all the bones, indeed, the female ones are, *cæteris paribus*, smoother and rounder, the cylindrical more slender, and the flat thinner.‡

After this unavoidably general sketch, it may be useful to give some illustrations of the necessity of attending to the subject.

An individual in one of the northern settlements of Upper Canada was suddenly missed, after having been seen to go into

* *Ibid.*, on the authority of Soemmering. Craigie's *Anatomy*, p. 78. Dr. Craigie found a male skeleton, measuring five feet six inches, to weigh 168 ounces, or ten and a half pounds avoirdupois. I presume that a skeleton *anatomically prepared* will be proportionably still less in height than what is stated above.

Orfila, from a number of recent experiments, thinks we should add from an inch and a half to two inches, to the height of the skeleton. (*Exhumations*, vol. ii. p. 380.)

† A comparative table of the dimensions of the pelvis of various human races, by Dr. Vrolik, is given in the *Bulletin des Sci. Médicales*, vol. ix. p. 290.

The whole subject of the changes in the bones (and particularly the teeth) from birth to old age, is treated in detail by Orfila. (*Leçons*, third edition, vol. i. p. 102; and *Dunglison's Physiology*, third edition, book 4.)

‡ *Elliotson's Blumenbach*, p. 412.

the woods. Diligent search was made, but in vain. About twenty years afterwards, portions of a human skeleton were discovered by some laborers, and remembering the above circumstances, they were taken to the deceased's friends. Anxiety was excited to ascertain by these the age of the person, and for this purpose the lower jaw, from which all the teeth had fallen out, was selected. Great diversity of opinion arose concerning it, both on the spot and in London, but most of the medical examiners pronounced it to be the jaw of an adult, and probably an aged one. On a more minute investigation, however, the permanent teeth were seen cased in their sockets, not one of them having appeared above the level of the alveolar process. It was evidently the jaw of a child.*

In 1800, at the English Devon assizes, Thomas Bowerman was preferred to the grand jury for the murder of a bastard child, by pushing an awl into its head. The body had been disinterred by order of the coroner, and on the inquest, a hole was found on the side of the head near the ear, agreeably to the testimony of a witness. Mr. Sheldon, a surgeon of Exeter, hearing of this case, attended the grand jury. He examined the skull, and found that the supposed hole was the natural perforation of a vein, and in proof of this, pointed out a sort of enamel round the opening, which could not have been there if made by force or art. In further illustration, he exhibited several skulls, all having similar perforations, and each hole having a small channel, and the rim or edge of the whole smooth and polished.†

Eugene Aram, the recollection of whose case has been recently revived by the popular novel, was indicted in 1758, for the murder of Clark in 1745. An accomplice indicated where the bones could be found, viz., in St. Robert's Cave, near Knaresborough. The skull of Clark was produced in court.

* *Lancet*, vol. x. p. 758. A somewhat similar case is related by Mr. Perfect, in *Lancet*, N. S., vol. xxiii. p. 704. One brother was supposed to have murdered another, and the crime was, after the lapse of many years, thought to be brought to light by the accidental discovery of the bones. Mr. Perfect examined these before the coroner's jury, and found that they were of an aged female.

† *Paris*, vol. iii. p. 80.

"On its left side was a fracture, that, from its nature, could not have been made but by the stroke of some blunt instrument, and could not be replaced but from within. Mr. Locock, the surgeon who produced it, gave it as his opinion that no such breach could proceed from any natural decay; that it was not a recent fracture by the instrument with which it was dug up, but seemed to be of many years' standing."

Aram, in his celebrated defence, suggests that these might have been the bones of hermits or anchorites, and cited cases of caves or cells where such had been found. As to the fracture, he stated that in 1732 the remains of William, Archbishop of York, were taken up by permission, and the bones of the skull were found broken, yet no violence had been offered to him while living. Knaresborough, also, had a castle besieged during the time of the Parliament, and many were killed near it.

Notwithstanding the ingenuity and force of these remarks, he was convicted, and before execution confessed his crime.*

I will only add the following case, and I have no doubt that its interest will compensate for the necessary detail:—

A Piedmontese soldier, aged forty-six, named Bonino, had retired to a village near Montpelier. He disappeared in 1823, and it was reported that he had gone to Spain; but soon after it was whispered that he had been assassinated by a girl with whom he lived, and a person named Diamont, who had long been intimate with her, and married her nine months after the

* Dodsley's Annual Register, 1759, p. 355. For his defence, see Paris, vol. iii. p. 311. The whole trial has been recently republished at Boston.

It is doubtful whether any aid can be furnished by chemistry, to ascertain the *age* of bones. Girardin and Priesser assert that they found in an ancient buried bone, and in the fossil bones of animals, a much greater quantity of phosphate of lime (in the form of sesquiphosphate, crystallized,) than in recent bones. They also found fluoride of calcium in fossil ones, but could not detect it in ancient human bones. Of this opinion, are Fourcroy and Vauquelin, Klapsoth, and Dr. Rees. But, on the other hand, Berzelius, Morichini, Dr. Daubeny, and Mr. Middleton have detected it in recent bones. The latter, however, states that in these it is in less quantity than in fossil ones. (London and Edinburgh Philosophical Magazine, vol. xxiv. p. 154; vol. xxv. pp. 14, 122, 260. See, also, Dr. J. L. Smith, in Silliman's Journal, vol. xlviii. p. 99; Dr. Wilson, in Edinburgh New Phil. Journal, vol. xli. p. 205.) This last asserts that he has detected the presence of fluorine in blood and milk.

disappearance of Bonino. Two years more, however, passed before an investigation, when the authorities caused a search to be made, and a body was found in the garden of the suspected person. The only peculiarity recollected about Bonino was that he had a sixth finger on the right hand, and a sixth toe on the left foot.

On the 30th of April, 1826, three years after his disappearance, Dr. Delmas attended the disinterment at the request of the magistrate, and it is his narrative which I am now giving:

At the depth of eighteen inches, a human skeleton was found lying on its back; the head was slightly bent forward, and the lower jaw was separated from the upper. The arms were crossed on the breast. The ribs, still retaining the form of the thorax, were separated from the sternum, which was found lying on the opposite vertebræ. Some black hair and a metal button were imbedded in a moist, earthy matter, which covered the anterior surface of the sternum. The vertebral column, unbroken, had retained its relations with the head and pelvis. The inferior extremities, stretched out, and on the same level as the trunk, followed the direction of the axis of the body, and inclined toward each other. The right foot, which alone we saw in place, was still in the shoe, a little bent on the leg, and inclined to its outer edge; the left had, in digging, been removed with the shoe, in which we found only a part of it.

The head, removed from its position, was dry in the frontal region, while the occipital was still moist and lubricated by a fatty matter, among which some black hair was seen. On attentively observing the skull, a deformity was observed at the right external orbital angle, but evidently arising from an injury long anterior to death, since nature had produced a cure. Another lesion, but also of ancient date, existed on the left side of the coronal suture. The left temporal bone, however, attracted most attention. Its squamous portion, almost separated from the parietal bone, was divided into three pieces by three cracks, which proceeded from the circumference of the bone and before the external auditory canal, united to a fourth, which turning round the base of the zygomatic process, terminated in the glenoid cavity. The form of this frac-

ture, and the soundness of the zygomatic arch and mastoid process, induced us to suppose that it was made with a blunt instrument of small size. From the absence of any apparent operation of nature to effect a cure; from the separation of the osseous pieces, and the oozing which took place through the different points of the fracture, we think it had taken place at a time very near death. Indeed, it is evident that the injuries observed were the result of a violent blow, that must have brought on a cerebral commotion, which, without considering other accidents, would instantly deprive the individual of the use of his senses and every means of defence.

The shoes in which the bones of the foot were found, some pieces of woollen cloth surrounding the vertebræ of the neck, metal and wooden buttons, a knife, of which the blade was folded in the handle and found at the left side of the breast, some fragments of cloth and velvet, all these inclined Dr. Delmas to believe that the body had been buried, covered with a part, at least, of its clothes.

As to the time during which this body had lain, it probably was three years, according to the descriptions generally given on this subject. This was confirmed by the absence of all gaseous products, by the fetid odor being replaced by an odor of moldiness, and by the remains consisting of earthy, friable, fatty, brownish, and black matter. The only soft parts found were vertebral ligaments, and these, as assimilating more nearly in composition to the nature of bone, ought of course to be the last to disappear.

The bones were now all collected, and the examinations continued on the subsequent day. The vertebræ, ribs, and bones of the pelvis were articulated. The outlet of the pelvis was narrow, the width of the passages small compared with the depth, the descending rami of the pubis had their anterior face directed outward, with but a small separation. All these led to the opinion that it was the skeleton of a *male*.

Next, as to *age*. The complete development of the bones, that of the processes to which the muscles are attached, the state of the teeth, being complete, with the exception of the fourth molar of the right side of the lower jaw, (which had been long out, as the alveolar cavity was ossified,) these induced

the witnesses to say that he had attained his fortieth year. According to the comparative tables of Professor Sue, his height was determined at about five feet five inches.

The bones of the extremities were nearly complete, and the right foot, which was preserved in the shoe, was articulated. Some bones of the left foot were lost in digging. They found only the os calcis, astragalus, scaphoid and cuboid, the five metatarsal and three phalanges. This prevented any articulation, and they were unable to ascertain whether anything was peculiar. The head of the fourth metatarsal was rounded, extending outward, and presenting a small articular surface, "which might have been produced by an extra articulation; but not having seen in what manner this bone was articulated with the first phalanx, we could not determine if there had been a sixth toe attached to it."

Except some small bones of the carpus, all those of the right hand were found. The fifth bone of the right metacarpus at once attracted attention. Shorter and thicker than that of the other hand, its extremity toward the phalanx separated into two parts, one of which, truly articular, smooth, narrow, rounded, and prominent, had the direction of the axis of the bone, while the other, corresponding to the cubital edge, formed with it an angle of about eight degrees; not continued so far as the first, it was equally smooth, and presented an articular surface, which differed from it only in its less rounded form. Having tried to articulate the first phalanx of the little finger, it fitted exactly upon the first articular head, and presented upon the side corresponding to the second a depression the obliquity of which was in relation with the direction assigned to the second surface.

It was evident from this examination that a sixth finger must have existed, although the bones could not be found. The left hand exhibited no peculiarity.

The deductions made by Dr. Delmas were, that the individual, whose skeleton he had inspected, was a male, of the age of forty or upwards; that he had six fingers on his right hand, and possibly a sixth toe on the left foot; that he had been murdered by a violent blow from a blunt instrument, which fractured the left temporal bone; and that he had been

buried in his clothes. Diamont and his wife were tried and convicted, and before execution confessed to Dr. Delmas their guilt in the manner specified by him.*

Some additional cases will be found in the works referred to below.†

I must not omit, in this place, a very curious case related by Mr. A. S. Taylor, and in which the contested IDENTITY was determined by the *teeth*. It might have been related under the above title, but there are some recent occurrences which induce me to place it here without any additional reference to them. The case is given in the words of Mr. Taylor:—

* This remarkable case I have taken from the North American Medical and Surgical Journal, vol. iv. p. 176. That journal, however, copied it from the Edinburgh Journal of Medical Science, who again translated it from the *Ephémérides Médicales* of Montpellier. It is also quoted in full by Orfila, (*Exhumations*, vol. ii. p. 360,) who, while he allows due credit to Dr. Delmas for his successful investigation, makes the following objections to his deductions: The age is not at all certain; it might have been of a person aged twenty-five or thirty, as well as one aged forty and upwards. It is equally impossible to fix the period since interment with so much precision. And lastly, the facts presented do not *positively* prove that the fracture was inflicted before death.

† *Annales d'Hygiène*, vol. xv. p. 214. Examination of bones found in a cellar, by Dr. Boys De Loury. The most interesting facts ascertained here were that the bones (they were those of a male and female, each aged from fifty to sixty years,) had probably been interred at least thirty or forty years previous. This appeared from their being entirely converted into phosphate of lime, every vestige of animal matter having disappeared, and from their falling into dust on the slightest pressure. (*Ibid.*, vol. xvi. p. 375. Case reported by Dr. Valette.) All the long bones had lost their epiphyses, and they were quite small. It was hence the skeleton of a child. Many of the teeth of the upper jaw were wanting. The incisives had been renewed, and of these three remained. The two canine were still concealed at the bottom of the socket, and the three large molar teeth had come out. In the lower jaw were equally evident marks of the second dentition. Dr. Valette was hence led to the conclusion that the age of this individual was about eight or nine years, and from further examination, that it was a male. No marks of injury were present. (*London Medical Gazette*, vol. xviii. p. 493.) Medico-legal disinterment in India, (from the *India Medical Journal*.) A man was supposed to have been murdered by beating, and a body was disinterred three months thereafter for the purpose of examination. Mr. Cheek, the surgeon, however, proved the want of identity. The whole of the bones were found clean and free from periosteum, ligaments, and cartilage, and, in his opinion, this could not have occurred within the year.

"It was a case which Mr. H. Reynolds and myself were called upon to investigate. It was a trial for murder, under circumstances in which the body was never discovered, and in which, as it happened, an important question of identity arose, founded on the presence of the incisor teeth in a female of advanced age.

"The case to which I allude is that of Elizabeth Ross, who was tried at the Old Bailey sessions in December, 1831, for the murder of a female of the name of Caroline Walsh.

"It appeared in evidence that the deceased, Caroline Walsh, who was an old Irish woman, had been repeatedly solicited by the prisoner to come and live with her and her husband, but the deceased refused. By much persuasion on the part of the prisoner, however, she at last consented, and went for that purpose to the prisoner's lodgings in Goodman's Field, on the evening of the 19th of August, 1831, taking with her her bed and an old basket, in which she was accustomed to sell tape and other articles. From that evening all traces of the deceased were lost, and when the prisoner was required by her relatives to account for her disappearance, she prevaricated, but finally asserted that she had gone out early in the morning of that day, and had not returned.

"The testimony of the prisoner's son, who was the chief witness for the crown, went to prove most clearly that the deceased had been wilfully suffocated on the evening of her arrival by his mother (the prisoner) placing her hands over the mouth of the deceased and pressing on her chest. He deposed that on the following morning he saw the dead body in the cellar of the house, and on the evening of the same day he saw his mother leave the house with something large and heavy in a sack. *This was at the time murders were being perpetrated in London to supply the anatomical schools with subjects for dissection.*

"Now it happened, most singularly, that on the evening of the 20th of August, the day following the alleged murder, an old woman, of the description of the supposed deceased, was found lying in the street in the immediate neighborhood, in a completely exhausted condition, and in a most filthy and squalid state. On being questioned, she stated that her name

was Caroline Welsh, and that she was a native of Ireland. Her hip was found to be fractured, in consequence of which she was conveyed to the London Hospital, where she subsequently died, and was buried. The prisoner, Ross, when apprehended, insisted that this was the female whom she was accused of having murdered. Hence, setting aside the direct contradiction given to this statement by the evidence of her son, it became highly important, for the ends of justice, that the identity or non-identity of the two women should be clearly established.

"The extraordinary resemblance of names, and the exact coincidence of time, struck every one in court; but by the examination of about twenty witnesses, the following points of difference were elicited. It was stated that they were both Irish women, but Caroline Walsh came from Kilkenny, Caroline Welsh from Waterford. The former (the alleged murdered person) was eighty-four years of age, tall, of a sallow complexion, gray hair, and had (an extraordinary circumstance for her years) very perfect incisor teeth. The latter, Caroline Welsh, (who died in the London Hospital,) was about sixty years of age, tall of stature, dark, like a mulatto, but had no *front teeth*; in addition to which it was deposed by a medical witness, that the alveolar cavities corresponding to them had been obliterated for a considerable time. The witness brought the skull and jaw into court, for the body had been previously exhumed for examination, *but the judge would not allow it to be produced*, and said he would be satisfied with the witness' statement respecting the condition of the jaw.*

"Other circumstantial points of difference were deposed to, as, for example, Caroline Walsh was healthy, cleanly, and neat in her person, and her feet were perfectly sound; Caroline Welsh was considerably emaciated, in a dirty and filthy condition, her hip broken, her foot covered with bunions and excrescences, and one toe overlapped another.

"The dress of the two women was somewhat similar. That of Caroline Walsh was most clearly proved to have been sold

* The skull of Adams, murdered by Colt, was, by order of Judge Wm. Kent, produced in the New York Court of Oyer and Terminer. C. R. G.

by the prisoner, Ross, to different persons, and almost every article was reproduced in court, and sworn to by witnesses. The clothes of Caroline Welsh were proved to have been burnt by order of the parish authorities. Both of these women had similar baskets in their possession, but that of Caroline Walsh had no lid or cover, while that of Caroline Welsh had. Lastly, the body of the latter was taken up from the burial-ground of the London Hospital for the purpose of identification, and it was sworn, by two of the granddaughters of Caroline Walsh, not to be the body of their grandmother.

"This is perhaps one of the most singular cases of disputed identity that has come before a British court of law. We have a coincidence of name, time, place, age, occupation, and circumstances so extraordinary, that but for two circumstances it is probable the prisoner would have escaped on the presumption of a mistake, the body of the deceased never having been found, although all the dissecting-rooms in London were repeatedly searched for it. These circumstances were—First, that the relatives of the deceased swore that the exhumed body was not that of the missing woman; and second, the medical proof of the entire obliteration of the alveolar cavities in the jaw of the exhumed body, proving that the incisor teeth must have been lost long before death, while several witnesses testified to the presence of these teeth as a striking peculiarity in the missing female. Even had the features of the exhumed female been obliterated by putrefaction, the non-identity would have been established by this medical fact.

"The prisoner was convicted and executed."*

The HAIR is another part of the body which continues long unchanged, and its presence may hence aid us in identifying individuals. It is frequently found in a perfect state on bodies buried a century or more, and indeed is seen but little altered on the mummy. Whether it *grows after death* [was long a disputed point, and some, even late authors, profess their belief in the occurrence. (Pariset and Villanne, in *Dict. des. Sc. Méd.*, art. *Barbe et Poil*.) It may, however, now be confidently asserted that this notion has no place in science. The shrinking

* London Med. Gazette, vol. xxxviii. p. 481.

of the skin may cause an appearance of growth in the beard, but it is apparent only.—C. R. G.]*

As a proper conclusion to this section, we notice the subject of PUTREFACTION in its bearing on legal medicine.

The earliest changes that take place in a body after death are coldness, stiffness, and lividity. Of all these, I may remark that their supervention is far from being uniform. The bodies of the adult and the aged take them on sooner than those of the young, and again the nature of the disease has a manifest influence. But the importance of these phenomena in doubtful cases deserves a more minute notice.

Ordinarily, *cadaveric rigidity* does not supervene until the animal heat is somewhat dissipated; in other words, coldness precedes stiffness. And this stiffness commences in the muscles of the trunk and neck, then attacks the muscles of the upper extremities, and lastly those of the lower.† It disappears in the same order. Nysten states that in proportion to the delay

* London Quarterly Review, vol. xlvii. p. 516. At the last meeting of the Microscopical Society of London, Mr. John Quekett, the microscopic demonstrator to the Royal College of Surgeons, read a very interesting paper on the importance of the microscope in the determination of minute structures of a doubtful nature. The author stated that his object in bringing this communication before the society was to point out how minute portions of skin, which had been exposed to the air for centuries, could be recognized as human. There existed in this country certain traditions that persons who had committed sacrilege were flayed, and their skins nailed to the doors of the churches they had robbed, as a terror to the sacrilegious, and three portions of such skin had been forwarded to the author for examination, by Albert Way, the secretary of the Archæological Society. The first was taken from one of the doors of Worcester cathedral, where now only portions remain underneath the ornamental clamps and hinges. The second specimen was taken from the church door of Hadstock in Essex, where it had been protected for many centuries by an iron grating; this portion of skin was said to have been that of a Danish pirate, and is supposed to be nearly 900 years old. The third specimen was taken from the church door of Copford, also in Essex. On all the specimens, Mr. Quekett succeeded in finding two or three hairs, which the microscope clearly proved to be human. Thus this valuable instrument is able to confirm a tradition, and prove the former prevalence of a practice which has been doubted by many archæologists. (London Medical Gazette, June 9, 1848.)

† Nysten is the authority for this; but Devergie observes that it involves a contradiction, since the trunk longest preserves its heat, and therefore should be the last to become rigid. (Vol. i. p. 63.)

of its coming on will be the length of its continuance, and vice versa. The operation of different causes will vary the period of accession. If death originate from acute inflammation of the stomach or intestines, from irritant poisons, from the inhalation of deleterious irritant gases, which exercise no specific influence on the contractile power of the muscles, as ammoniacal gas, chlorine, or deutoxide of nitrogen, severe rigidity ensues, and continues for some time. But if death arise from a disease of a debilitating character, from the inhalation of sulphuretted hydrogen, or, indeed, in any case where there has been great exhaustion of the system prior to dissolution, the rigidity supervenes speedily, and disappears after two or three hours.

From these facts, it will readily occur that rigidity may be delayed by keeping the body in a warm atmosphere, or more certainly by immersing it in a warm bath, while cold will produce a contrary effect. In some cases of asphyxia, and particularly from hanging, or from the inhalation of carbonic acid gas, the animal heat being retained later than usual, the rigidity will be slower in its approaches.

It must, however, be remembered that there is a *spasmodic* rigidity in some instances following, or remaining after death, while the animal heat remains, or is but little impaired. This may be the result of nervous diseases, as apoplexy, inflammation of the brain and its membranes, tetanus, etc., and also of intoxication, and some of the forms of asphyxia. It is considered by some as the result of a last contraction of the muscles, and it continues for an hour or more; coldness then follows, and at last true cadaveric rigidity.

The application of this in legal medicine is important. In the case of a person who dies asphyxiated, and when the limbs are stiff, while the heat is but little impaired, Orfila infers that the death must have been very recent; and this *spasmodic* rigidity may thus in some instances be a guide as to the time when it occurred.*

* Orfila, Leçons, vol. ii. p. 194; Taylor's Med. Jurisprudence, p. 69; British and Foreign Med. Review, vol. ii. p. 425. I am indebted to this last for a proper view of this important point. Some cases, illustrative of its importance, are noticed in the section on strangulation. In a person who committed suicide, (in February, 1837,) rigidity was complete one hour and a half after

After a certain period,* these phenomena are succeeded by *putrefaction*, but many circumstances are found to advance or delay its progress. Heat, humidity, and the contact of air, accelerate it, and it is almost always rapid when, as in typhoid disease, it appears to commence before life is extinguished. Interment, also, if made early, procrastinates it. Some species of earth have a similar effect. It is not, however, all degrees of heat that accelerate it. A temperature too high may even prevent it, owing to the rapid dissipation of moisture. In the route from Tripoli to Mourzouk, Dr. Oudney often found the ground strewn with the skeletons of the unfortunate victims of the slave-trade. The skin and membranous substances were seen shriveled and dry, and the thick muscular and internal parts were alone decayed. If the dry and hot air of the desert produces such effects, we can readily imagine how similar causes, although acting in a less powerful manner, may operate in different countries at particular seasons of the year.

Cold, on the other hand, is also well known to retard putrefaction. "Below 50° Fahr., the process is slowly performed, and at 32° it is altogether suspended. The temperature most favorable to its perfection is from 60° to 80° or 90°. This is the temperature of our summer, and hence at this time putrefaction is most rapid." †

death, while the animal heat remained. (Case by Dr. Handyside, Edinburgh Med. and Surg. Journal, vol. xlix. p. 221.)

* Devergie has given some rules for ascertaining the time since death, grounded on the progress of the above phenomena; but they are evidently only approximations, as many circumstances may interpose to delay their consecutive development. I will briefly state his deductions:—

First period. Some heat remaining, with more or less relaxation of the muscles; death may have occurred from two to twenty hours.

Second period. The heat is gone, cadaveric rigidity is present; death has occurred from ten hours to three days.

Third period. All the parts are relaxed, the color of the skin is natural; the muscles do not contract when electricity is applied; death has happened from three to eight days.

Fourth period. The size of the body is increased by the development of gas, the abdomen is of a greenish color; death from six to twelve days.

All these, however, suppose the body to have been unburied and exposed to an ordinary temperature. (Vol. i. p. 86.)

† Dr. Beatty, *Cyclopedia of Practical Medicine*, art. *Persons found dead*, vol. iii. p. 322. "Nous savons que tout étant égal d'ailleurs, la putrefaction

This is a brief statement of the principal causes that accelerate or retard the process in question. It will, however, be understood that several accessory ones may occasionally have an effect. And among these there is none more deserving of remembrance than that pointed out by Mr. Alfred Taylor, viz., that there will be a material difference in the advance of putrefaction, according as the body is *mutilated or entire*. "Those parts," he observes, "which are affected at the time of death, by contusions, ecchymosis, or extravasations of blood, become much more speedily decomposed than those in a *normal* condition. If there be any solution of continuity, or loss of substance, accompanying these extravasations, the effect will be much more strongly marked." The correctness of this is every day verified in the dissecting-room. Bodies in which incisions are made advance much more rapidly toward decomposition than such as are left untouched. The application of all this in legal medicine is obvious. "When the body of an individual, who is suspected to have died from external violence, is not seen until some time after dissolution, the injuries will appear to be of a much more aggravated nature than they ought to be considered by the medical jurist." *

I will now give the details of a case already referred to, which excited great interest some years since in the United States. The leading points agitated were, *the period when putrefaction supervenes*, and *the growth of the hair after death*.

Francis Baker left Moore's tavern, in the town of ———, Kentucky, after having slept there, at about sunrise of the 2d of November, (Tuesday,) 1824. He proceeded to Doggate's, and breakfasted in company with Desha and others, at an early hour. Baker and Desha left Doggate's at very nearly the same time, and were again seen together at a quarter of a mile from that tavern. Baker was not seen after this, until he was found a corpse six days after, (Monday.) His throat was cut, and there were five wounds on the side of his head, apparently

s'empare plus lentement du cadavre d'un individu mort par hemorrhagie, que de celui dont les vaisseaux sont distendus par le sang." (Orfila's Exhumations, vol. i. p. 329.)

* Taylor's Med. Jurisprudence, p. 90; Devergie, vol. i. p. 156.

from blows, as the skin was broken. There appears to have been a wound on the breast, but concerning this there was some conflicting testimony.

The place where the body was found was a hollow, though not steep until you approached near to the body. One of the witnesses, on being asked whether the sun could shine on it, replied that he did not suppose that it could; it was his impression that the body was rather from the sun. The woods were tolerably thick around the place, there being a good deal of undergrowth. The body was lying near a log; the thighs were next to the road, and the head down hill.

Desha was indicted for the murder, and it became an important question to ascertain whether the state of the body was compatible with the idea of violent death inflicted *six days previous*. I shall endeavor to condense all the evidence on this point.

On the state of the weather, as likely to influence the process of putrefaction, there was much conflicting testimony; it certainly snowed one day, and probably there was frost several nights.

The corpse was a little stiff when taken up, but after carrying it for some time, it became limber. It had no smell of putrefaction. On Tuesday there was no alteration in it, and but little on Wednesday. On Thursday it turned black, and was somewhat offensive. The wounds appeared to be fresh, and bled much when Dr. John Drake examined them. The body was not swollen when found, but on Wednesday, or shortly before it was interred, which was on Thursday, the abdomen and face were greatly swollen. A fire had been kept in the large room where the corpse lay.

Dr. John Drake examined the body on Wednesday, after it had been washed and dressed. He thinks there were five wounds on the head, all severe, and generally two inches in length. There was a large wound of the throat, about four inches in length; another on the breast, and another on the shoulder. There were no symptoms of putrefaction about the body, and hardly any smell. Dr. Charles Scudder saw the body (probably) on Wednesday, and observed some blood or bloody water issuing from the wound. This, he stated, was

such as would result after the corpse had lain for some time, and not as from a fresh wound. In answer to a question whether he inferred that the wounds had been recently made, he replied that he did not examine those on the head, but that on the throat did not appear fresh.

The discussion elicited by these facts is not without interest. Dr. Drake testified that the absence of putrefaction was not, under the circumstances, proof that the man had not been dead ten days.

Dr. Frazer stated that it was not unusual for a corpse, in eight or ten days after death, to become limber; and upon being moved, to discharge from the wounds, nostrils, etc., a part of the serous portion of the blood, inasmuch as a relaxation of the muscles, and a loss of the coagulable powers of the blood, were the first symptoms of putrefaction; that the length of time before any symptoms of putrescence can be discovered, depends much on the weather, whether cold or warm, and on the manner of death, as he had known bodies to lie throughout the winter without exhibiting any symptoms of it, and as the process of putrefaction is much slower to commence in a body that has died from great loss of blood, than in ordinary cases of death.

The counsel for the prisoner, of course, dwelt much on this absence of putrefaction as a proof that the death must have been recent. The judge (Shannon) himself inclined to this belief. "It is difficult to suppose," said he, "that a body, at this or any other season of the year, could have remained that long without exhibiting some symptom of putrescence; connect, also, that in two or three days after it was found, it did show such symptoms as in that time might naturally be expected."

As to the other point, it would appear from the testimony on the inquest, that the beard was quite short when first seen, and had the appearance of being recently shaven. In the interval between Tuesday and Thursday it appeared to have got a little longer. It was stated, at the same time, that the face had become swollen.

The counsel for the prisoner appears to have taken it as a conceded fact, that the *beard will grow after death*. Mr. Rowan, an eminent advocate, said that the fact was tested in numerous

instances of disinterred bodies. "An acorn," said he, "after it has fallen, produces the oak. Cut down a buckeye in the spring, when the leaves are just budding, and they will grow until the sap which is up is exhausted; just so in relation to the beard."

If this position was deemed correct, it furnished another proof against the supposed period of the murder. The medical witnesses, however, were far from agreeing to so positive an opinion. They conceded that, in some cases, the beard appeared to grow after death; but that this was owing to the collapse or shrinking of the flesh which thus gave it a more prominent appearance.*

The presence of the putrefactive process is not, however, to deter us from the necessary examination. We have an efficient agent in the chloride of lime or soda, to remove any unpleasant odor. And it should be sprinkled around the room, or on the table where the body lies, and not on the body itself, since it is found to change both the color and consistence of the parts. Not unfrequently, indeed, a subcarbonate of lime has been formed on the surface from the union of the liquor with the gases that are emanating.

Although dissection may thus be pursued with advantage, and often to the elucidation of doubtful cases, yet this is precisely the period when disputes concerning the *identity* of dead bodies frequently occur. The characteristic features become lost, and we can only depend with safety on such peculiar physical marks as may have been present. On a trial that took place some years since at Edinburgh, for stealing subjects, where the body had been interred nine weeks before the recognition, Dr. Barclay, the anatomist, testified that the longest time he ever knew during which the features remained recog-

* "Trial of Isaac B. Desha, for the murder of Francis Baker, held at Cynthiana, Kentucky, before the Hon. George Shannon, reported by Robert S. Thomas, and George W. Williams, Lexington, 1825." [Desha was twice convicted, but in both cases a new trial was granted; while awaiting his third trial he attempted to commit suicide; he was subsequently pardoned by his father, who was then governor of Kentucky. Little doubt of his guilt is now entertained in Kentucky.—C. R. G.]

nizable, was a fortnight. Yet a witness swore particularly to the identity of the body.*

For an accurate knowledge of the successive changes of the body in its progress to complete decomposition, we are indebted to the indefatigable labors of Orfila; and I will conclude this section with a short abstract of the more striking facts noticed by him.

The *epidermis* is very rapidly destroyed. It separates from the surface, is converted into a greasy, reddish-brown substance, and finally disappears. If, however, it has been detached during life, by an effusion of serum beneath it, it will then long resist putrefaction. The *nails* soften, and are readily detached. They lose their semi-transparency, and in process of time become dry. The *hair* strongly resists decomposition, and remains unaltered for years. The *cutis* is at first yellowish, but soon takes a greenish, reddish, and violet tint. At a later period, small, sand-like granulations, consisting of phosphate of lime, form on it. It gradually dries, becomes darker in color, and is covered with the greasy mold already spoken of. The *subcutaneous cellular tissue* dries on the anterior portion of the body, but becomes infiltrated, soft and tender on the dependent part. At a later period, the adipose part of it begins to saponify, and is of a grayish-white color, and of the consistency of suet. This, however, is not invariable. Finally, what is not thus converted, becomes dry, brown, and is at last destroyed.

The *muscular tissue* softens at first, takes a greenish tint, is gradually reduced to a jelly, and in fat bodies changes to soap; in others it dries. The *aponeuroses and tendons* preserve for a long time their brilliancy and firmness, but after a while become yellow, and then brown. The tendons resist putrefaction longer than any other part. The *ligaments and cartilages* resemble the tendons in their changes. The last, however, before they disappear, become black and fragile. The *bones and teeth* are

* G. Smith's Forensic Medicine, second edition, p. 506. There must, however, be sufficient latitude allowed for the season, and the nature of the ground in which the body has been interred. All I mean to urge is, that grievous mistakes are often made from too great confidence. In the notes to the chapter on *Age and Identity*, several instances are given by Dr. Dunlop.

indestructible by this process. The *serous tissues* become gray and softened, then from blue to black before they disappear. Orfila recognized the pleura in a body interred in a thick coffin, and raised fourteen months after death. The brain does not putrefy so rapidly as might be supposed from what happens when it is removed out of the cranium. For several weeks after interment, if the weather be moderate, it preserves so much of its natural appearance that we can trace its different parts. After this, however, it softens gradually to a thin greenish paste, at first intolerably fetid, but finally without this, and much diminished in bulk. The *nerves* remain permanent for many months. The *eyes* sink and rapidly decay; nothing is then found but the fat peculiar to dead bodies; in not a single instance of disinterment did Orfila find a vestige of them four months after death.

The *lungs* are at first congested in the manner we have already described, and their structure does not alter rapidly. They finally become green, soft, and shrunken, and lastly, dry and black. The *diaphragm* also decays slowly, and both it and the lungs have often on their surface the white granulations of phosphate of lime. The *heart* softens, grows gradually darker in color, collapses, and is reduced to a few blackish filaments. The *blood-vessels*, for two or three months after interment, contain a certain amount of black blood, either fluid or coagulated. They also change in color, and their respective coats are readily separable. The *stomach* presents a great variety of appearances shortly after death. Much depends on the quantity of blood accumulated in its vessels, and the comparative state of health or disease in that organ during life. So also with the *intestines*. In a short time the mucous membrane of both becomes greenish, and sensibly softened, then dark and black, and finally the whole substance dries into membranes, which at last are converted into a moist black mold. The *liver* softens, forms granulations on its surface, then becomes blackish-brown, and not unfrequently, instead of drying, is converted into a black substance resembling the grease of wheels.* The *gall-bladder*

* Ollivier D'Angers and Chevallier have recently discovered a peculiar substance produced from all or most of the soft organs, but particularly the

alters slowly. The other viscera soften soon, lose their texture, and are converted into the greasy matter already noticed.

In all his examinations of disinterred bodies, every portion of the face was destroyed between the third and fourth month, although the bones still remained slightly attached by their articulations. The thorax rarely undergoes any change for the first three months. So also with the abdomen, except the change of color in its integuments. After that it collapses, and its parietes become very thin.

Orfila also observed that the shorter the time between death and burial, the more slow will be the progress of putrefaction. So also in proportion to the depth of the grave. If buried naked, it occurs more rapidly than when clothed. Contrary to the received opinion, which assigns at least three years, he has, in a majority of cases, found bodies reduced to a skeleton at the end of 14, 15, or 18 months, even when buried in coffins and wrapped in clothes.

With respect to the fat or soapy matter, of which I have repeatedly spoken, Orfila conceives that it is never formed but in those parts of the body in which there exist fat and azotic matter. This is the *adipocire* of the older chemists, which, according to Chevreul, consists principally of margaric and oleic acids, and ammonia. Nearly three years are necessary to convert bodies buried in earth into it, while in water, as we shall hereafter show, the transformation is much more rapid. The soil also, and the number of bodies interred together, have a striking effect in producing this change. If not fat, but dry and meagre, and lying in separate graves, saponification rarely occurs.*

In some instances, margarate and oleate of lime, and carbonate or sulphate of ammonia are formed, owing, as Orfila sup-

liver, about three months after interment. It is a white, hard matter, in the form of irregular granulations, and disposed either in bands or zones. It is found on the surface or in the interior of the liver, and on the internal wall of the veins and arteries. On analysis, it was found to consist of an ammoniacal salt, a fatty matter, muriate of soda, and traces of some other salts. It is thus evidently formed from the decomposition of the body, and cannot be mistaken for poison. (Edinburgh Med. and Surg. Journal, vol. xl. p. 488.)

* Orfila's Exhumations, vol. i. p. 22.

poses, to water containing the salts of lime infiltrating through the earth to the bodies.*

II. *Of sudden death from natural causes.*

Sudden death from natural causes most commonly originates from one or other of the following affections: apoplexy, rupture of an aneurism or of a large vessel into one of the cavities, bursting of purulent cysts, ossification of the valves of the heart, rupture of this organ, bursting of some blood-vessels into the air-passages, and idiopathic asphyxia. The passions, whether exciting or depressing, (but most commonly the former,) are frequently the agents in producing the fatal termination.

Apoplexy is a disease which in some instances may be mistaken in its early symptoms, and may terminate fatally in situations which preclude any observation of the event. We should here attend to the conformation of the body—the large head, short neck, and plethoric frame, to the posture in which

* This is of course but a very brief analysis of the *Exhumations Juridiques* of Orfila. The parts relative to bodies found in water I shall notice under the head of *persons found drowned*, and the state of the stomach and intestines under that of *poisons*. I must add, that I have been indebted to an excellent analysis of the first volume, in the North American Medical and Surgical Journal, vol. xii. p. 42.

Dr. Lee describes the appearances found in the stomach and upper part of the intestinal canal of a corpse which had been interred for three months, and then exhumed for medico-legal investigation. The mucous surface of the stomach was of a deep chocolate color, and on it were scattered numerous white circular bodies, elevated at the edges and depressed at the centre; some of these were very minute and had the appearance of a white powder sprinkled on the membrane. This appearance has been noticed by Orfila as one of those which had been mistaken for arsenic. Buchner, too, has mentioned a white, granular substance containing fat, which was found lining the stomach. The question arises, what is the intimate nature and origin of these bodies? Are they fungi? They are certainly not calcareous depositions. They are partially soluble in alcohol, and they melt before the blowpipe. (Dublin Journal.) A correspondent in the Provincial Journal found similar appearances in a body which had been interred fifteen months. These particles, examined chemically, yielded the same results as adipocire, of which they probably consist. (Lancet, April 20, 1844.) Certainly this last is the correct solution. Orfila examined these appearances, (found equally in the stomachs of those who had not been poisoned,) and ascertained that they consisted of fat and albumen.

the person is found, the food that he has recently eaten, the ligatures that surround any part, and, above all, to the appearances on dissection. There is, however, a form of this disease, denominated *simple apoplexy* by Dr. Abercrombie, which is often fatal within the twenty-four hours, and leaves in the dead body no traces, not even congestion of the vessels within the head. Here, if there be no marks of injury, we are of course precluded from a charge of violence; and it is only necessary to remember that persons seized with apoplexy may have fallen from a height, and thus wounded themselves.*

The ruptures or burstings that I have enumerated have sometimes been indicated by premonitory symptoms; but even if their previous history be unknown, dissection will explain their nature.†

Idiopathic asphyxia was first described by Mr. Chevalier. The patient, often apparently in perfect health, becomes faint, and suddenly expires. On dissection the heart is found flaccid, and all its cavities are empty of blood. Dr. Beatty relates a case that occurred to him, of a healthy female in the ninth month of pregnancy, who suddenly expired after a very slight sickness and attempt to vomit. Every part was carefully examined, and he observes that he had never seen a healthier

* Dr. Bright mentions several instances that came under judicial examination, in which the cause of death was shown to be apoplexy. In some of these he found nothing but very slight effusion, and *tumors in the choroid plexus*. (Medico-Chirurgical Review, vol. xx. p. 7.)

† See art. *Rupture of the Heart*, by Dr. Townsend, in Cyclopaedia of Practical Medicine, vol. iv. Rupture of the aorta, mistaken at first for poisoning, Lancet, N. S., vol. viii. p. 227. Also, a valuable essay on Rupture of the Heart, and the morbid appearances associated with it, by Dr. Hallowell, in American Journal Medical Sciences, vol. xvii. p. 74. Dr. H. states that there are no less than sixty cases on record—with a *very few* exceptions, death occurred instantaneously.

I omit a long list of references to individual cases, that I have collected for examination and comparison, and will only further refer to Dr. Copland's Dictionary, art. *Rupture of the Heart*, and an analysis of Dezeimeris' essay on the same, in Medico-Chirurgical Review, vol. xxxiii. p. 531.

Cruveilhier (Anatomie Pathologique, 30me Livraison) asserts that the seat of the rupture is exclusively the left ventricle, and nearly always at or near its top. This, however, is not confirmed by other examiners. Out of forty-four cases noticed by Townsend and Baylé, six were rupture of the right ventricle. (London Med. Gazette, vol. xxvi. p. 559.)

condition of the organs. The heart, however, though sound, was flaccid, and all its cavities were empty, while its proper veins were much distended with blood.*

As examples of sudden passion hurrying these diseases to a fatal crisis, the following may be cited from Paris: "Dr. Gordon Smith mentions the following case as occurring in one of the midland counties of England. In the course of an altercation between a man and his wife the woman died, and a clamor was raised that the husband had murdered her. An inquest was held, a verdict returned against him, and he stood his trial at the following assizes. He was, however, acquitted, for it appeared in evidence that he had not even touched his wife during the quarrel. The deceased was a person of extremely violent temper, and on opening her body it was found that she had been laboring under suppuration of the liver, and that an abscess had burst into the cavity of the abdomen, in consequence of the agitation into which she had been thrown." Again, Baron Larrey describes the case of a person who had been severely wounded in the thorax, in a duel, but was recovering, when in the fourth month from the period of the injury, he died suddenly during a violent fit of anger. On

* Chevalier and Wood's cases, *Medico-Chirurgical Transactions*, vol. i. p. 157; Beatty, *Cyclopedia of Practical Medicine*, vol. iii. p. 325. The total want of blood in the heart would not, however, appear to be invariable, as Professor Christison quotes an undoubted case from Rochoux, in which the auricles contained a large quantity of it. (*Edinburgh Medical and Surgical Journal*, vol. xxxi. p. 242.)

This is confirmatory of the remarks of Devergie, who, in his observations on the modes in which death may supervene, divides those originating in the heart into three kinds: 1. From syncope. In this instance, he observes, congestion in any particular organ is not to be looked for, but the blood is more or less generally diffused. 2. From a spontaneous or accidental rupture of the right side of the heart. Here its contractions diminish or cease, less blood is sent to the head, which also loses its power; thus less force is imparted to the inspiratory muscles. On examination, the veins are seen filled with blood, and there is but little in the lungs, brain, and left heart. The chemical phenomena necessary to life have first ceased, and then the mechanical. 3. When the left side is affected in a similar way, the order is reversed—the mechanical first ceases to act, and, on dissection, the lungs and left heart are seen gorged with blood; the arteries are empty, while the right side of the heart and the veins contain but little. (Devergie, vol. i. p. 54.)

dissection, the heart and pericardium exhibited traces of inflammation.*

Dr. Christison, in a recent publication, has added some very valuable observations and useful cautions to this branch of our subject.† The facts, that "sudden death from latent causes frequently occurs where collateral circumstances lead to a suspicion of violence, and that these are apt to prove suddenly fatal from the operation of slight violence, or of circumstances incidental to violence, as anger, struggling, and the like, and that the appearances they leave may present the same characters as those from death by violence," are so many strong circumstances to demand a careful examination.

The principal diseases that he enumerates as often existing for a long time, without seriously incommoding the patient or alarming his friends, are of the *head*, sanguineous apoplexy, and inflammation of the cerebral membranes or of the substance of the brain. As to the first, he remarks that the presence of a clot in the brain, particularly if it be plainly of some standing, would not of itself be enough to account for death. Inflammation of the membranes may proceed to such an extent as that considerable effusions and even suppuration may be present without marked symptoms. And this circum-

* Paris, vol. iii. p. 15. There is also a remarkable case related by Professor Mott, of sudden death in a female deserted by her paramour. She had been dissolute and probably intemperate, but was robust, and had not complained of any indisposition beyond slight rheumatic pains. She was dejected on going to bed, and in the morning was found dead, without any appearance of suffering. On dissection, the left ventricle was found ruptured, and an abscess was seen in its parietes. The pericardium contained a large quantity of coagulated blood. (Transactions of the Physico-Medical Society of New York, vol. i. p. 151.) A case of rupture of the duodenum without external injury, but originating in a fit of anger, is mentioned by Dr. Dupuy, in the *Journal Médicale de la Gironde*, vol. vi. p. 147.

† *Cyclopedia of Practical Medicine*, vol. iv. art. *Latent Diseases*. There is also a good article on the causes of sudden death, in the *London Medical Repository*, vol. xxvii. p. 725. Dr. Southwood Smith has considered this subject in six lectures, (part of his course on *Forensic Medicine*,) published in the *London Med. Gazette*, vols. xxi. and xxii.

See also Dr. Edward Warren, on *Sudden Death*, in *American Journal Med. Sciences*, vol. xxiv. p. 294, and a discussion on the same subject at the *Westminster Med. Society*, reported in the *Lancet*, N. S., vol. xxvii. pp. 306, 309, 311.

stance is applied to a medico-legal case. A son, in a state of intoxication, was left struggling with his father, aged seventy, of passionate disposition, but in good health. Seven minutes after, the old man was found dead, on his back, with the mark of two blows on the nose and forehead, not particularly severe. On dissection, no fracture, extravasation, or laceration could be found; but there was an effusion of half a pint of reddish serum in the ventricles, and also toward a pint of serum in the cavity of the pleura on each side of the chest. Some medical men ascribed death to the effusion, and the effusion to the blow. But undoubtedly this effusion could not have occurred in seven minutes, and was more probably the result of previous disease. Softening or ulceration of the substance of the brain is also frequently observed in those dying suddenly.

Of the latent diseases of the *chest*, Professor Christison enumerates pleurisy, peripneumony, and organic diseases of the heart. Each of these may pursue its course for a long period without exciting suspicion.* So also of ulcerations of the membranes of the *stomach* and intestines, chronic derangements of the viscera, extra-uterine conceptions of various kinds. Some develop themselves sooner than others, but all have occasionally concealed their formidable nature until the last moment.

In recurring to the fact that all of these are most apt to prove suddenly fatal under the operation of violence, and thus bring the case before a legal tribunal, Dr. Christison advises attention to the following sources of exculpatory evidence: 1. When the morbid appearances indicate that derangements of structure or function have been induced, incompatible with the continuance of circulation or respiration. As when a rupture of the heart produces a large effusion of blood into the pericardium. 2. When appearances are seen, which, although not incompatible, as we should suppose, with life, yet are known

* *Pulmonary Emphysema as a Cause of Sudden Death.*—Attention to this subject has been excited by the labors of M. Prus and others. Their researches prove that in many cases of sudden death, pulmonary emphysema was present, and that in some it was the probable cause of death, even where no difficulty of breathing or other symptom indicated the existence of disease of the lungs.

seldom or never to occur, except when death speedily follows. Of this may be mentioned rupture of the gall-ducts or gall-bladder, or a recent perforation of the stomach. 3. Another description of evidence is derived from the symptoms immediately before death, corresponding with the appearances discovered. 4. We can often decide, and particularly in cases of suspected poisoning, that the circumstances noticed will not bear out the idea. 5. It is not an unfrequent occurrence for sudden death from latent disease to take place during the early stage of convalescence from other diseases, from some unusual or violent exertion, or from some emotion of mind, and particularly anger.*

I subjoin as interesting, the following statement by Devergie. In forty cases of sudden death examined by him, the causes were as follows:—

Apoplexy.....	4
Serous apoplexy with pulmonary congestion.....	2
Congestion of the brain and spinal marrow.....	3
Pulmonary congestion.....	12
Pulmonary and cerebral congestion.....	12
Hæmatemesis.....	2
Syncope.....	3
Rupture of the heart.....	1
Rupture of the pulmonary artery.....	1
	<hr/>
	40

The age most liable is from 40 to 70 years; the subjects were principally from the male sex, and the majority of cases

* On the first appearance of malignant cholera at Sunderland, a female attacked with it died in twenty-four hours. She had been engaged in a brawl the day before, and had received a slight wound with a fork. "This death occurred at an early period of the epidemic, when many influential persons, including some medical men, were loudly asserting that no unusual disease existed in the town. It was therefore very generally asserted that the patient had died of the wound and of blows on the head and face, the marks of which, it was said, were so very obvious." The body was examined in the presence of medical men of both opinions, and the questions finally set at rest by a coroner's jury. (Edinburgh Med. and Surg. Journal, vol. xxxviii. p. 124.)

In the section on *Strangulation*, I shall mention some cases of accidental death, or rather apoplexy mistaken for it.

occurred in the winter. Intemperance was one of the most common causes.*

Dr. Tourdes reported, in 1842, to the Scientific Congress meeting at Strasburg, a notice of the sudden deaths in that city. In twenty-six cases, as ascertained by dissection, they were—

Apoplexy (cerebral hemorrhage).....	1
Serous apoplexy.....	1
Cerebral congestion	4
Cerebral and pulmonary congestion.....	1
Hæmoptysis	1
Foreign bodies in the bronchiæ.....	2
Pulmonary congestion	13
Syncope	1
Perforation of the intestines.....	2
	<hr/>
	26

The blood was fluid or mixed, with diffuent clots, in two-thirds of the cases, while in the same number there was or-

* Devergie on Sudden Death, in *Annales d'Hygiène*, vol. xx. p. 145. We must not forget that sudden death sometimes occurs during pregnancy, particularly extra-uterine, as where the Fallopian tube is ruptured; or during labor, when the aorta or other large vessels give way. (Dr. Merriman mentions two cases in which the internal iliac vein suddenly ruptured and immediate death followed.) Dr. Meigs relates a case of death in thirty-six hours, when the female previously had been in good health, from a rupture of the Fallopian tube, which contained a fœtus of probably six weeks, *Philadelphia Med. Examiner*, vol. ii. p. 709; and Dr. Gavin, a similar one in eight and a half hours from the same cause, in *Lancet*, No. 894, p. 135. Dr. Lindsly, *ibid.*, death in twenty-five hours. *Boston Med. and Surg. Journal*, vol. xxix. p. 9. Mr. Meadows, in *Lancet*, No. 1079, May 4, 1844. Hemorrhage of the ovum in the Fallopian tube. Death in fifty-four hours.

Dr. Munk relates a fatal case of rupture of the Fallopian tube, in a female eighteen years of age, who had never menstruated, and in whom the menses had accumulated to such a degree as to cause the injury. Death, however, did not occur under several days. (*London Med. Gazette*, vol. xxvii. p. 867.)

Alex. Watson, death in thirty-two hours, from rupture of an extra-uterine conception within the Fallopian tube. (*Edin. Med. and Surg. Journal*, vol. lx. p. 362.)

There is also an interesting case of sudden death in a female from rupture of the spermatic vein, related by Dr. J. McNaughton, in *Transactions Med. Society State of New York*, vol. iv. p. 334. There was here, however, no pregnancy present.

Buffalo Med. Journal, vol. vii. p. 592. Case of Fallopian pregnancy, with rupture, by Dr. Watkins, of Wisconsin. Death in fifteen hours.

ganic disease of the heart—hypertrophy. The cases were most numerous in the winter.*

III. *Death from violent causes.*

This division of our subject may with justice be considered as the most important in the whole range of medical jurisprudence, not only from the number, but the variety of cases that come under examination. In commencing their investigation, it is necessary to remark that a particular term, asphyxia, has of late years been much employed to express the peculiar mode of death that occurs in most of them. As at present understood, asphyxia means “those cases of the cessation of the heart’s action which arise from a particular cause, namely, the interruption of respiration, or, to speak more correctly, the interruption of the effect produced by that function on the blood.”

The phenomena of respiration are twofold, mechanical and chemical. To the former we refer the motion of the ribs and diaphragm in performing inspiration and expiration, and to the latter, the inspiration of oxygen and its results. Now, it is rather the popular idea to consider asphyxia principally in reference to the chemical changes induced. There cannot, however, be a doubt but that mechanical obstructions are equally efficient agents. The following division of asphyxia, by Savary, and many other modern writers, will illustrate these ideas:—

1. *Asphyxia from mechanical impediments to respiration*, as by compression of the chest and abdomen, as seen in cases of large quantity of ground falling on persons digging, etc.; by air entering into the cavities of the chest or abdomen; by a wound of the diaphragm, with pressure of the abdominal viscera upward. 2. *Asphyxia from want of power in the respiratory vessels*, as from a division of the spinal marrow; from lightning; from cold; and from general debility, as in new-born children.

3. *Asphyxia from want of air*, by its rarefaction; by suffocation; by submersion; by strangulation. 4. *Asphyxia from*

* London Med. Gazette, vol. xxxi. p. 526.

want of respirable air. 5. *Asphyxia from irritating or deleterious gases.*

Each of these causes has phenomena in some degree peculiar to itself, which will be most usefully considered under its appropriate head, yet there are some common to all, which may be here briefly indicated.

The symptoms consequent on impeded respiration are more or less striking, as well as rapid in succession, according as the obstruction is more or less complete. Among the earliest are a sensation of distress, and an effort to dilate the chest. The struggle is longer or shorter, according to circumstances, and convulsive movements accompany it, with suffusion of the face, swelling of the veins, protrusion of the eyes, etc. Torpor, before long, succeeds, often with a general relaxation even of the sphincter muscles. The heart, however, continues for a brief period to propel the venous blood it receives from the pulmonary vessels. This also ceases, and life is at the instant of departing.

In more protracted cases, it has been noticed that there is less suffusion of the face, but a more extensive discoloration of the skin on other parts of the body.

On examination after death, these spots are distinguished from those observed in dead bodies kept in one position, by being seen in all parts, and, according to Dr. Roget, by having their seat chiefly in the mucous membrane of the skin. Rigidity generally occurs late, but is more strongly marked, and continues probably longer than in other cases of sudden death. The eyes are distended, and often protruded.

A great accumulation of blood is observed in the pulmonary vessels, and in the right auricle and ventricle, and their great veins, while the left auricle and ventricle are comparatively empty. The liver, spleen, and kidneys are gorged, the lungs distended, and the blood thick and dark colored, and but rarely coagulated. If the struggle has been violent, the vessels of the head are found full, particularly the veins and sinuses; and a section of the cerebral substance exhibits an unusual number of red points, and often an effusion of serum into the ventricle. On the contrary, when the death has been easy, the vessels of the brain are often natural.

These are the principal appearances noticed. There are others, which will hereafter be pointed out as peculiar to various causes.

My limits preclude me from going into detail concerning the theory of asphyxia. In addition to a reference to authorities worthy of examination, I will only remark that the earliest opinion entertained was, that the cessation of the motion of the heart in these cases was owing "to some mechanical impediment to the transmission of the blood through the lungs. But the experiments of Goodwyn and others have sufficiently proved that no such mechanical obstruction exists. It is now universally admitted that the arrest of respiration is owing to the non-aeration of the blood, and that this arrest takes place first in the pulmonary capillaries while it is continued in other parts of the body. Hence its accumulation in the lungs and right heart, and the empty condition in which the left heart and the arteries are usually found. It was long believed, on the authority of Bichat, that the circulation of venous blood was actively poisonous, and that consequently an animal was worse off when black blood flowed in its arteries than though it had no supply of blood at all; but the experiments of Kay and Edwards prove conclusively that the venous blood has not the active poisonous agency supposed, and that consequently the symptoms of asphyxia result not at all from its presence, but from the absence of arterial blood. To throw light upon the cause of this arrest of the circulation in the pulmonary capillaries, Allison confined a rabbit in azote till its respiration became labored, and then, taking it out, killed it so suddenly by a blow upon the head that it never respired, though it was strongly convulsed. He found the right heart gorged with blood, while the left was comparatively empty. Hence it appears that the circulation fails equally, and is arrested at the same point, although the movements of respiration continue, if oxygen is not inspired. Oxygen has, then, a peculiar power of promoting the circulation through the capillaries. Dr. Allison concludes that the motion of the blood through the lungs is in part dependent on causes other than the heart and arteries. Kay asserts that death in these cases of asphyxia results neither from the poisonous influence of the venous blood on the brain

and other organs, nor from the absence of arterial blood in the vessels, but from an accumulation of blood in the lungs, and a constant diminishing of the quantity sent to the rest of the system; but to this theory it may be objected that this accumulation of blood, though very common, is not universal; cases occurring where, if not entirely absent, it is certainly present only in a moderate degree. The following cases of asphyxia, under very peculiar circumstances, are of sufficient interest to deserve a permanent record. They occurred in the operations for clearing the deck of the *Royal George*. The divers are equipped with a water-proof dress of Macintosh fabric, with a metallic helmet resting on the shoulders, to which is attached a tube, through which air is forcibly pumped from above. The divers generally remain below from half an hour to an hour or more, without any inconvenience, and return with their inner dress of flannel perfectly dry. On the 4th of October, 1841, while Roderick Cameron was below, the air-tube burst near the pump; he was instantly hauled up by the safety line attached to him. The first disagreeable sensation he experienced was an unusual pressure of the helmet and leads against the collar-bone and chest, followed by an urgent feeling of suffocation, after which he speedily lost all sensation; he was drawn up in a little more than one minute; and a few seconds elapsed before the helmet was removed. He remained lying on the vessel's deck, on board which he was drawn, for about a quarter of an hour, when he showed signs of consciousness, and was able to speak; in about an hour he was received into Haslar Hospital. The pain in the head, dimness of sight, soreness of throat, and other effects of the accident disappeared in four or five days. A little blood only escaped from his nose, and none from his ears and mouth. His head, neck, and eyes were, however, ecchymosed, and this continued for several weeks. "At the expiration of a month, the ecchymosis under the conjunctivæ, which remained the longest, had disappeared, and, undaunted by the perilous accident which had jeopardized his life, he returned to his work as a diver, which occupation he still fearlessly follows."

Mr. Liddell, the author of the above communication, gives the particulars of a similar and later case.

John Williams, aged twenty-six, of great strength and activity, but addicted to intemperance, had been employed for two summers on the wreck of the Royal George as a diver, and was considered one of the most expert workmen. On the morning of the 11th of July, 1842, while clothed in his submarine armor, he was engaged at the bottom of the sea, at the depth of eighty feet from its surface, in fastening an iron chain round a block of wood that was imbedded in the stiff mud; which task, after an hour's labor, he had just completed, when the flexible tube that supplied him with air suddenly burst above water, with a loud hissing noise, which was distinctly heard at the distance of fifty fathoms. The persons stationed at the air-tube immediately perceived the accident that had happened, and one of them closed the hole in the tube with his hand. Williams was promptly hauled up, but his armor got entangled in the heavy rope-ladder by which the divers descend, and he and it were pulled up together in the space of about a minute and a half from the occurrence of the accident.

On removing the helmet from his head, blood was seen running in a stream from his ears, nose, and mouth. His face and neck were swollen and discolored; he looked faint, but was sensible. In this state he was conveyed to the hospital, where he arrived in an hour after the accident. His face then was one mass of lividity, his neck was excessively swollen, bloated, and suffused with livid-colored blood. Dark patches of ecchymosis, that did not coalesce, existed over the clavicle and shoulders, with intervening spaces of skin of the natural color. The lower part of the neck, which had been covered with the flannel and India-rubber dress, was mottled black and white, the dark ecchymoses being raised in lines, with slight streaks of white skin interposed. The livid discoloration of the face extended upward to, but did not pervade the hairy scalp, where it terminated abruptly, nor were any spots seen below that part of the chest which was covered with the helmet. The lining membrane of the cheeks, under the tongue, over the fauces and pharynx, as far as the eye could reach, but especially over the tonsils, was black with ecchymosis. The conjunctivæ, where they are uncovered by the eyelids, and particularly round the margin of the corneæ, were turgid with

black blood. He vomited some blood before he reached the hospital, and he afterwards made occasional efforts to vomit, apparently from the accumulation of blood in the fauces, which blood he now and then expectorated. The hemorrhage had ceased from the nose and ears, which were still covered with clotted blood. He was perfectly sensible, but seemed drowsy; pulse 76, of natural strength; breathing interrupted by frequent deep and involuntary sighs.

Lieut. Hutchinson, who was present when the accident happened, and who accompanied Williams to the hospital, said that the swelling of the face and neck had much increased, and the lividity had much deepened, during the hour that had elapsed since he left the hulk.

In the course of the same day, the lividity of the nose and point of the chin vanished, and those parts resumed their natural color. The color of the face, too, became much paler, in proportion as the vessels recovered their freedom and diameter; but there were large patches of extravasated blood in the eyes, mouth, face, and neck, which could only be removed by the tedious process of absorption. On his admission, warmth was applied to his extremities; some warm tea was given him, which he swallowed with the greatest difficulty; he had a turpentine enema, and in the course of the day twenty ounces of blood were taken from his arm. The following morning a senna draught was prescribed. He has complained of occasional headache and dimness of sight, but of this, at the date of the report, (August 8th,) he was now free. The swelling and ecchymosis of the face and neck have daily diminished, and these parts have now attained their natural size and color, showing that they were swollen, on his admission, to twice their natural size. The ecchymosis under the conjunctivæ were very tardily absorbed, and minute clots were visible for three weeks around the union of the cornea and sclerotic coat.

Mr. Liddell refers to a third case, similar to the above, of a diver at the wreck of the frigate *Thetis*, in South America. Here too, the air-tube burst, and the individual became entangled with the bell, so that there was some delay in bringing him to the surface. When he reached it, his face and

body were blackened with ecchymosis down to the *waist*. The discoloration gradually went off in the course of a month, the blackness of the balls of the eyes being the last to disappear.

These curious and strikingly similar effects are supposed by Mr. Liddell to arise from the sudden removal of the compressed air, and the consequent exertion of the pressure of the superincumbent water on those parts of the body which are not covered by the unyielding helmet. In the case of Williams, this pressure at the moment of the accident is supposed to have been nearly equal to the weight of three atmospheres, and which was counteracted and the equilibrium preserved, by throwing air through a forcing-pump of great power, along a flexible tube, into his helmet. When the tube burst, the equilibrium was destroyed. The head was protected by the strong helmet, and did not collapse from the pressure of the circumambient water, which now acted on the rest of the body with a force equal to two atmospheres, and produced a feeling, as he expressed it, as if he had been crushed to pieces by his dress. The blood thus driven from the extremities, and from those parts of the body that were not covered by the helmet, was forced into the vessels of the head and neck, (as it is into a part of the skin placed under a cupping-glass,) some of which blood remained in the vessels, and disappeared in a few hours after the accident, but a large portion was extravasated in the loose textures in which it had been forcibly driven.*

* I refer those who are desirous of studying this subject, to the following authorities :—

Dictionnaire des Sciences Médicales, vol. ii. art. *Asphyxia*, by Savary.

Cyclopedia of Practical Medicine, art. *Asphyxia*, by Dr. Roget.

Copland's Dictionary, art. *Asphyxia*.

Mr. Brodie's views, in Paris' Medical Jurisprudence, vol. ii. p. 16.

Goodwyn, Kite, Kay, on *Asphyxia*.

Williams, in Edinburgh Medical and Surgical Journal, vol. xix. p. 524; Kay, in do., vol. xxix. p. 37; and in North of England Med. and Surg. Journal, vol. i. p. 453.

Lancet, N. S., vol. xiv. pp. 315, 387.

Reviews of Kay, in Edinburgh Medical and Surgical Journal, vol. xlii. p. 216; Medico-Chirurg. Review, vol. xxv. p. 92; and London Medical Quarterly Review, vol. iii. p. 46.

Review of Roget, in Edinburgh Med. and Surg. Journal, vol. xxxix. p. 394.

In further noticing this subject, I shall arrange my remarks under the following subdivisions:—

- A. Of persons found dead from cold.
- B. Of persons found dead from hunger.
- C. Of persons found dead from lightning.
- D. Of persons found dead from burns.
- E. Of persons found dead from wounds.
- F. Persons found dead from noxious inhalations.
- G. Of persons found hung.

Goodwyn's answer to Bichat, *Edinburgh Med. and Surg. Journal*, vol. xxxiv. p. 74.

Thomas on Asphyxia, in *Lancet*, N. S., vol. ix. p. 814.

Hodge on Sedation, *American Journal of Medical Sciences*, vol. x. p. 104.

An Analysis of Edwards on the Influence of Physical Agents on Life; *Medico-Chirurgical Review*, vol. xxii. p. 1.

Taylor's *Medical Jurisprudence*, vol. i. chapter i. On Asphyxia.

Hays' *American Cyclopaedia of Practical Medicine*, art. *Asphyxia*, by Professor Dunglison.

Dr. Marshall Hall's *Gulstonian Lectures*. (London, 1842.)

Dr. Jno. Reid read a paper before the British Association at Glasgow, in September, 1840, "*On the manner in which vital actions become suspended in Asphyxia.*" The correct knowledge of this suspension, he stated, depended on the explanation of the nature of the impediment of the circulation of blood through the lungs, and of the cause of the arrest of the sensorial functions. Three causes have been assigned to explain the first—the cessation of the mechanical movements of the chest; the effect of venous blood on the contractility of the heart; and the difficulty of transmitting the venous blood through the capillaries of the lungs, when the chemical changes which go on there have been arrested. Dr. Reid minutely described the mode by which he conducted the experiments entered into, to decide which of these is the true explanation, and from which he concluded that the impediment to the circulation through the lungs arose entirely from the cessation of the chemical changes which go forward there in a state of health, and not upon the arrestation of mechanical movements in the chest, or the impairment of the irritability of the heart by venous blood. The suspension of the sensibility in asphyxia was concluded to depend upon the accumulation of venous blood in the vessels of the brain, and not on the diminished quantity of blood transmitted through these vessels. (*Edinburgh Med. and Surgical Journal*, vol. lv. p. 437.)

In the same work, vol. lxiii. p. 1, will be found an *Experimental Inquiry into the Pathology and Treatment of Asphyxia*, by Mr. Erichsen. He arrives at the following conclusions: That the cause of the stoppage of the circulation in asphyxia is threefold—depending, 1. Upon the arrest of the respiratory movements. 2. Upon the weakening of the heart's action. 3. Upon the obstruction offered to the blood (propelled with diminished force) by the refusal of the pulmonary veins and minute arteries to receive venous blood.

H. Of persons found strangled.

J. Of persons found smothered.

K. Of persons found drowned.

The subject of poisoning, as I have already stated, is so extensive that I shall postpone it to a distinct chapter.

I may also premise that, in many medico-legal cases, a most difficult question often arises, after all doubt is removed as to the immediate cause, and that is, whether death is owing to suicide or homicide. I shall have occasion to notice this under most of the subdivisions, and will now only direct the reader's attention to some preliminary inquiries.

The moral history of the individual should, if possible, be ascertained, his disposition of mind and his worldly condition. The insane, we know, are very prone to commit suicide, and, therefore, any circumstance tending to establish a disordered state of mind deserves notice. It is proper to ask, whether the individual has met with any losses or disappointments, whether he has been solitary in his habits, and whether any of his family or connections have an interest in his death. It is sometimes said that, apart from the influence of fanaticism or insanity, suicides will generally select a certain and easy mode of death; but this is too broad an assertion for all cases. In some, however, the mode itself is presumptive either for or against.*

The season of the year may have some effect, and in very many instances dissection develops some chronic affection of long standing, which may have had its influence. Thus Morgagni found in the brains of maniacs an extraordinary hardness, and Durande and Fourcroy, along with this condition, observed an induration of the liver, and calculi in the gall-

* "In France, the proportion of suicides to homicides is nearly as five to three: consequently, if a dead body be found in France, without any evidence appearing for the cause of death, there is much greater probability of the deceased having fallen by self-violence than by the hands of an assassin. If it appears that the deceased has died by suffocation or strangulation, the probabilities for suicide are so greatly increased, as, in the absence of other evidence, to justify a verdict." (Foreign Quarterly Review, vol. xvi. p. 108, American edition.) I have strong doubts whether this is an accurate deduction, as it purports to be, from the remarks of Quetelet. At all events, unless hanging be included under the general term *strangulation*, the probability is certainly, in the instances specified, directly the opposite.

bladder. Esquirol and Osiander mention scrofula, affections of the genitals, organic diseases of the heart, chronic enteritis, etc., as especially predisposing to the commission of suicide.

Each case, however, has its peculiarities, and demands a close and deliberate examination.*

A. Of persons found dead from cold.

Death from exposure to cold, if it happens at a distance from towns or dwellings, is generally characterized by circumstances not to be mistaken. It may, however, occur in populous places, and is then more liable to misconstruction and suspicion.

The common and early effects of severe cold are sleepiness, stupor, and numbness. The individual is unwilling to be roused from this state, and has no apprehension of its fatal consequences. In the march from Moscow, where, however, the French soldiers labored under the combined effects both of hunger and cold, the insensibility and disposition to sleep often came on while they were walking. And although able to continue this for a short time, yet they could not be made to understand anything addressed to them. Beaupré remarks that the muscles of the trunk were the last to lose the power of contraction. The pulse was small and insensible, and there was a quiet delirium present.†

* The following case, (from Hecker's Annalen,) in addition to several others that I shall notice particularly under Wounds, will serve to show the difficulty that sometimes happens in discriminating :—

A Silesian butcher caught his wife in the act of adultery. The effect was to drive him into a state of distraction. He dashed his head several times against the wall, but finding this ineffectual, he took a cleaver and struck himself violently on the forehead with the edge of the instrument until he fell dead from the loss of blood. It is supposed that he must have inflicted at least one hundred wounds on himself.

This was done in the presence of several persons ; but suppose his dead body had been found with these marks of injury upon it, and no counter-vailing evidence, would not murder have been suspected ? (London Medical Repository, vol. xxviii. p. 83.)

† Beaupré on Cold, translated by Dr. Clendenning. Larrey's Surgical Memoirs, p. 78. Anything that weakens the nervous system, as hunger, intoxication, etc., renders the individual insensible to the effects of cold.

It is evident that the effects of extreme cold are to contract the external capillaries, and thus drive the blood to the internal parts, and some refer the constant tendency to lethargic apoplexy to the determination to the head that is thus induced.

According to Mr. Brodie, the effects of cold are—1. To lessen the irritability and impair the functions of the nervous system. 2. To impair the contractile power of the muscles. 3. To cause contraction of the capillaries, and thus lessen the superficial circulation, and stop the cutaneous secretion. As to the mode of its operation, he imagines that “it probably destroys the principle of vitality equally in every part, and does not exclusively disturb the functions of any particular organ.”*

We have but few accounts of dissection in these cases. Dr. Kellie, of Leith, examined the bodies of two persons found dead after a severe storm, on the night of the 3d of November, 1821. There was nothing remarkable in the external appearance of either. But little blood flowed on dividing the scalp. The dura mater was congested and suffused, and its sinuses loaded with black blood. The pia mater was turgid and congested. In each, also, between three and four ounces of serum were found in the ventricles and at the base of the brain. Not only did the appearances in the head thus correspond in these two individuals, (a male and female,) but even the stomach and small intestines were precisely similar. The stomach was of its usual pale color; the small intestines were deeply colored from a general and minute injection of their vessels. The liver was congested.

Dr. Kellie does not deem the effusion of serum a *post-mortem* production, and inclines to the opinion that it was produced in the short interval between their exposure and death. Its occurrence in both is certainly a forcible argument in favor of this supposition; but it may, as in a former case, have been existing previous to the accident.

Other authorities, as Rosen, Cappel, and Martin, (but all uniting in the same statement,) are quoted by Kay and Copland.

* Paris, vol. ii. p. 61.

As the cases on record are so few, the following, related by Dr. Vose, of Liverpool, may be added in this place:—

A healthy boy, when greatly heated and exhausted by play, was seen to plunge his head and neck several times in a vessel of cold water. The same night his bed-fellow heard him rise several times, when he was attacked with violent retching. On the next morning he required assistance in dressing, but walked without support into the next room, complaining only of sick-headache. Dr. Vose saw him at 5 P. M. He was in a drowsy state, and moaning in a low tone. He was roused when sharply spoken to, and, for a short time, would answer coherently to the questions addressed to him. His countenance was depressed, the eyes were bloodshot, but bore exposure to the light without causing suffering. The pupils were of the natural diameter, and the iris contracted readily. There was no complaint of headache or ringing of the ears. The breathing was somewhat hurried; the abdomen soft, and free from tenderness; the tongue moist and very white; and the pulse about 104, slightly irregular and vibrating. Upon causing the patient to sit up, an effort which he was able to make unassisted, he became suddenly wild and violent in his manner and language. He made no complaint of pain, except in such a manner as prevented any confidence in his statements; thus he would at one moment refer his uneasiness to the side, and, when questioned in a few minutes afterwards, he said it was the shoulders that gave him pain. Despite the absence of any decided local suffering, the restlessness, alternating with drowsiness and the general expression of the countenance, were such as to excite great apprehensions of his safety.

Dr. Vose directed leeches to the head, a blister to the nape of the neck, and the exhibition of a mercurial purge, but in less than two hours after his visit he was sent for in great haste, and found his patient dead. It had not been preceded by convulsions or spasms.

Dissection twenty-four hours after death. There was more than the ordinary amount of cadaveric congestion at the surface. The blood was universally fluid. The external coverings of the cranium were singularly exsanguine. The meningeal vessels were minutely injected; those of the substance of

the brain were in a similar state. There was no effusion either between the membranes or into any of the cavities of the brain, nor could any softening be detected anywhere. The morbid appearances were those which indicate extreme congestion. The encephalon was of large size, and weighed three and a half pounds.

The lungs were very closely connected with the costal pleura by broad, short adhesions; these were all cellular. There was no fluid in either pleura, and the substance of the lungs, with the exception of the inferior lobe of that upon the left side, was healthy. The upper three-fourths of the lobe were condensed, friable, and of a deep-purple color. Upon examining the surface of the inflamed lobe where it had been incised, its areolar structure was seen to be obliterated, and the granular appearance characteristic of hepatization was distinct. The pleura, where investing the affected part of the lung, was crusted by two or three patches of albuminous exudation; these were thin, adherent to the membrane, and apparently recent.*

* Edinburgh Monthly Journal Med. Science, vol. i. p. 190. Dr. Vose, in his remarks on this interesting case, says that it is by no means an anomalous one. All are familiar with the dangerous results to Alexander, from plunging when worn out with toil, into the waters of the Cydnus. Dr. Franklin once knew of an instance of four young men, who, having worked at the harvest in the heat of the day, with a view of refreshing themselves, plunged into a spring of cold water; two died on the spot, a third the next morning, and the fourth recovered with great difficulty. Dr. Currie, also, in his Reports, gives an account of an individual who, after a fatiguing journey on foot, plunged, at the close of the day, into a stream of water. "No reaction succeeded, but a feverish chill remained for some time, with small, frequent pulse, and flying pains over the body. Warm liquids and friction brought on at last considerable heat; and, toward morning, perspiration and sleep followed. Next day, this person was extremely feeble, and though he had only to perform a short distance, he was obliged to take the assistance of a carriage."

Such are the facts on this subject, but their causes have been as yet but imperfectly studied. Dr. Edwards has done little more, when speaking of the momentary effects of cold to the surface, than to announce his arrival, by a series of inductive experiments, at the knowledge of a fact, valuable if it do no more than indicate the fallacy of former opinions, and furnish a clue to future research. He observes: "There is more than the prolongation of a strong impression from the exposure to cold, more than a simple

The absence of any marks of injury is a guide in cases of this kind, especially when other circumstances point to the cause in question. "When a person is found dead from the effects of extreme cold, there are no marks of external violence or internal suffering. The body lies as if in a deep and calm sleep, without any external appearances to guide us as to the cause of death, except perhaps a swelling of the extremities, which has come on prior to death."*

As a supplement to this division, I must say a few words on sudden death from *drinking cold water*. Dr. Rush was the first writer who distinctly noticed it. He states that during the warm weather of summer, but seldom unless the heat is above 85°, as many as four or five persons have died in a day from drinking a large quantity of cold water. The symptoms induced were dimness of sight, muscular weakness, so that the patient suddenly falls down, difficult breathing, rattling in the throat, suffused countenance, livid extremities, imperceptible

affection of the nervous system: there is an alteration of function, a *diminution in the production of heat*."

The appearances found on dissection, according to Dr. Vose, closely resemble those detailed by Dr. Kellie, of Leith, in an account which he has published of two instances of death from exposure to cold. In his cases, as in Dr. Vose's, very little blood escaped upon dividing the investments of the cranium, while internally, extreme turgescence of the meningeal vessels was noticed.

"The unequivocal signs of inflammation presented by the lungs in this case is a singular and apparently inexplicable occurrence, from the very few hours which elapsed between death and the enjoyment of perfect health, and during which the patient had no symptoms of pectoral affection.

* Dunlop's MS. Lectures on Medical Jurisprudence. Dr. Ozanam, of Lyons, mentions the following case as another mode in which cold may cause death. A cruel stepmother, after a long course of ill treatment by beating and starvation, took her daughter, aged eleven, on a cold morning in December, and forced her to enter a barrel filled with water. Although extricated by a servant after some time, she was again replaced by the brutal mother, and in it she died. On the trial for this crime she was condemned to imprisonment for life. This refined species of cruelty, remarks Dr. Ozanam, presents a new subject for inquiry in legal medicine. There was no submersion, nor the ordinary effects of cold, nor any internal lesion, but an actual *assideration*, (a word which I confess I do not understand,) produced by the external application of cold. (*Annales d'Hygiène*, vol. vi. p. 207.)

pulse, and death, all in the course of some five or ten minutes. Others again were seized with spasms, and died in them.

The fatal consequences at the season in question are not, according to Dr. Rush, restricted to cold water alone, as he has known punch, beer, or toddy, drunk under similar circumstances, to produce equally fatal effects.

It has, however, been strongly questioned whether the cold drink is so important an agent in producing these effects as was supposed. It is urged that the heat of the body varies but little at any time; that farmers, during harvest, constantly drink water drawn from wells, which is decidedly colder than the water in cities, and yet these effects are unknown in the country. Again, Dr. Dickson, of Charleston, South Carolina, a city in the "fervid South," states that such cases are unknown there. He has never heard of one during the whole period of his practice, and yet ice and iced waters are in constant use. An English traveller, speaking of Naples, observes: "It surprises some strangers to see that the Neapolitans, at the hottest time of the day, and when they are in a state of the most profuse perspiration, from the effects of work or of walking in the broiling sun, will stop before one of these temples and take off a large glassful of the coldest water at a draught and with impunity. But this they all do often several times a day, even in the hottest weather. We believe, also, that few foreigners live long at Naples without doing precisely the same thing, and with just the same impunity."

These discordant observations inclined many physicians to believe that a state of commencing apoplexy was present in many of the instances, induced by the heat of the sun, or *insolation*, as it is called, by the *exhaustion from severe labor*; for it is generally laborers who are attacked, and by the previous irregular habits, since some, though not by any means all, had been intemperate. The drinking of a large quantity of cold water at once, when these symptoms were impending, and the patient already feels a great degree of muscular debility, was supposed to have a decided effect in producing the instant development of the attack.

[This subject has been very well studied by several American

authors, foremost among whom may be placed Dr. Israel Moses, late of the U. S. Army, whose paper, published in Collins' Reporter, October 18, 1845, contains a very good account of these cases in their varieties. Dr. M. speaks of three classes of cases:—

1. Those suddenly attacked, during exposure, with symptoms of cerebral apoplexy. Symptoms, vertigo, ringing in the ears, loss of consciousness, coma, and death.

2. Those who, after long exposure and usually great fatigue, fall in a state of exhaustion without any symptoms of apoplexy. Symptoms, those of collapse, the patient staggers, has dimness of vision, cold sweat, and soon becomes insensible, face pale, extremities cold and clammy, pulse barely perceptible. This is a case of simple nervous exhaustion.

3. Those who have taken cold water when much heated. Symptoms, sense of inward sinking, nausea, pain in the stomach with tenderness, weakness in the limbs, consciousness sometimes lost, sometimes mere listlessness, face pale, respiration slow, pulse rapid and feeble, in some cases there are violent cramps. These are the views of Dr. Moses, as published in 1845. In a note received from him, May, 1859, he says further experience has confirmed his views. Many cases have been seen by him among soldiers in southern latitudes. In the march from Vera Cruz to Mexico many soldiers fell victims to solar heat and fatigue. Cases of the same sort are frequent among firemen on board steamers in southern climates. An English officer informed Dr. M. that of the cases he had seen, both in India and the Crimea, a large proportion occurred in men just arrived in camp for the night. The prevailing, and I think the correct opinion as to such cases is, that a very large majority are from mere nervous exhaustion, (Dr. Moses, 2d class;) that a few are cerebral apoplexy or sun-stroke; and that if cold water have any agency, its effects are secondary and cumulative to those of pure nervous exhaustion.—C. R. G.]

The rapidity with which the bodies of persons thus dying pass into putrefaction, and the season of the year, have prevented us from deriving any information by means of dissec-

tions. The publicity and alarm that are excited are generally sufficient to exclude the idea of violence.*

B. Of persons found dead from hunger.

The crime of permitting or causing individuals to die from hunger is no doubt rare in civilized countries. Instances have, however, happened; and an account of the appearances observed after death is therefore proper.

The body is much emaciated, and a fetid, acrid odor exhales from it, although death may have been very recent. The eyes are red and open. This appearance is uncommon from other causes of death. The tongue and throat are very dry, and the stomach and intestines contracted and empty: this last mark has been repeatedly noticed. Haller dissected the body of a person who destroyed himself by hunger, and found the organs in question entirely empty; not the least vestige of fæces was to be seen in the intestines. The gall-bladder is puffed with bile, and this fluid is found scattered over the stomach and intestines, so as to tinge them very extensively. The lungs are withered, but all the other organs are generally in a healthy state. The blood-vessels are usually empty.†

* The following are the principal American authorities on this subject:—

Rush on the disease occasioned by drinking cold water in warm weather, in *Medical Inquiries and Observations*, vol. i. p. 181, second edition.

Dr. Higginson, in *Boston Medical and Surgical Journal*, vol. iii. p. 289.

Dr. Watts, in *New York Medical and Surgical Register*, p. 81.

Prof. Dickson, in *American Journal of Medical Sciences*, vol. iii. p. 262.

Prof. T. D. Mitchell, in *North American Medical and Surgical Journal*, vol. x. p. 379.

Dr. Brewster, in *Chapman's Journal*, N. S., vol. ii. p. 98.

Dr. Bartlett, in *Boston Medical Magazine*, vol. iii. pp. 86, 174.

Most of these writers concur in considering the phenomena as altogether those of apoplexy. New York, Philadelphia, Boston, and Albany seem to be the places in which most of these sudden deaths occur.

† Foderé, vol. ii. p. 276; vol. iii. p. 231; who quotes the observations of Morgagni, Redi, Valsalva, and Haller.

London Medical and Physical Journal, vol. xv. p. 510. Case of death from spontaneous abstinence, by Dr. Desgenettes, of Paris. Here the lungs were sound, but the gall-bladder and stomach were in the state described above.

American Cyclopedia of Practical Medicine, art. *Abstinence*, by Dr. Hays. He quotes the case of a prisoner, who, in two months, starved himself to

Prof. Horner, in consequence of some observations made by him, is of opinion that the substance of the brain in these cases becomes many shades lighter than natural, showing the destitution of red blood. This is confirmed by a case below.*

There is, however, some distinction to be taken between the effects of death from fasting, or from hunger. The former is slower in its progress, and consequently may occasionally present appearances different on dissection. An Italian writer has recently endeavored to designate these, and mentioned as among the peculiar results of death from hunger, inflammation of the stomach and intestines, and a rapid tendency to putrefaction.† Of the two, however, the last is more frequently mentioned than the first.

Collard de Martigny's experiments on animals tend to elucidate this subject. He starved dogs and rabbits, and the effects were excessive emaciation, and a diminished size and colorless state of the muscles. The heart and large vessels contained but little blood, and the lungs were empty; the viscera generally pale, but the gall-bladder large and distended with limpid, greenish-yellow bile; the stomach contracted, as were also the

death at Toulouse. The brain was paler than usual; the lungs nearly natural; œsophagus contracted, but not the stomach, which contained a little fluid; the lower portion of the small intestines red, softened, and highly injected; large intestines natural, and containing fecal matter; the gall-bladder much distended with black, thick bile; the muscles much attenuated.

In Kelsey's case, (related by Dr. McNaughton, in the Transactions of the Albany Institute, vol. i. p. 113,) who lived for fifty-three days on water alone, the stomach was loose and flabby, and the mesentery, stomach, and intestines extremely thin and transparent; the gall-bladder as in all the preceding cases.

Case by Dr. Sloan. London Medical Gazette, vol. xvii. pp. 264, 389. An individual was confined for twenty-three days in the Kilgramie Coal Works, Ayrshire. He survived three days after being discovered and extricated. His bowels acted only once when in the pit, but he made water freely. He had no stools during the last three days, except from injections, which brought away very black and fetid matter. His intellect was perfect until his death. On dissection, the brain and its membranes were found healthy, but there were fewer marks of blood-vessels than usual. The omentum had almost disappeared. The stomach and intestines were healthy, and the gall-bladder was distended with bile.

* Horner's Pathological Anatomy, p. 360.

† American Journal of Medical Sciences, vol. i. p. 472.

intestines, which last were tinged with bile. In three cases only, out of eighteen, did he find any marks of inflammation in the digestive canal. The quantity of fibrine in the blood was sensibly diminished. He does not seem to have examined the brain.*

Still later, the experiments of Chossat have added to our knowledge of this subject. They obtained for him the gold medal for Experimental Physiology in 1841, from the Royal Academy of Sciences in Paris. His memoirs were published in 1843, and I will only quote from them such observations as immediately concern the subject of legal medicine.

M. Chossat's experiments were made on pigeons, turtle-doves, common fowls, Guinea-pigs, rabbits, and several cold-blooded animals, as frogs, tortoises, serpents, etc.

Forty-eight warm-blooded animals of all the species were totally deprived of food and drink, and the first important point ascertained was the constant but gradual diminution of weight. If the loss of the first day be abstracted, the loss of weight, till toward the close of life, was nearly the same each day. The first day always exhibited a greater amount of loss, in consequence of the bowels evacuating the remains of the last food. All this being otherwise equal and taking a period equally distant from the hour at which inanition began, the loss was great in proportion to the bulk of the body. Toward the end of life, an increased amount of diurnal loss in weight was observed—a circumstance attributable to the increased amount of alvine evacuations, or even smart diarrhoea, which often then occurred.

One of the most interesting points ascertained by M. Chossat, was the absolute average amount of weight lost before death took place. The average result of all his experiments, whether with fat or lean animals, showed that before death ensued the weight of the body was reduced four-tenths of what it had been when they were shut up to be starved. And when this occurs death ensues. But it may be modified by circumstances. Thus, if the animal be loaded with fat, it sometimes lives till it

* North American Medical and Surgical Journal, vol. vii. pp. 196, 221, (from Magendie's Journal.)

has lost five-tenths or one-half of its weight. Age, also, exerts a powerful modifying influence. Very young animals often die after losing only two-tenths of their weight, and the loss in them never exceeds four-tenths.

The time which an animal, deprived of all sustenance, will live, varies much. In birds and mammalia, the average duration of life, under starvation, was nine days. The maximum, however, was twenty days and a half, and the minimum was a little more than two days. Here, again, age exerted a powerful modifying influence. In very young animals death occurred by the end of the second day, while in adult animals the average duration of life was from fifteen to eighteen days. It is, however, a remarkable circumstance that the longer life was prolonged, or to be prolonged, the less was the amount of daily loss, and the sooner death occurred the more rapid was the diurnal loss of weight.

* The next series of experiments undertaken by M. Chossat was conducted on the principle of allowing a very insufficient quantity of food. For some animals there was given a very limited supply of both food and drink; to others, insufficient solid food alone; and to a third, water only.

In the first series it was singular to remark that when they died their loss of weight was found to be very nearly the same as if they had been totally deprived of food. The duration of life was, however, nearly double.

A supply of water seemed to prolong life in reptiles, and somewhat lengthened it in quadrupeds, but had no influence on that of birds. The water, however, must be voluntarily taken, since if forced to swallow a quantity equal to their daily loss of weight, their lives were shortened.

As animals killed by starvation thus lose four-tenths of their weight, it became a matter of importance to ascertain what organs of the body had been chiefly attacked to supply this loss. The fat, of course, first disappears; but this is not an essential organ. It is the muscular system, and the heart in particular, which bears almost the whole loss. Hence, a softened state of the muscular system. The nervous system appeared to have lost none of its original volume or weight,

though every other organ of the body was reduced both in volume or weight.

The animal heat falls rapidly in animals that are starved, and death occurs in warm-blooded animals when the temperature falls as low as $76^{\circ} \frac{81}{100}$ Fahrenheit. This is the temperature at which animals die which are plunged in refrigerant mixtures, and we may therefore infer that death ensues in consequence of the cooling of the body below what is sufficient for the purpose of life.

Symptoms of starvation. The animal remains calm from the beginning of the experiment till the half of the period which they live, or sometimes nearly the whole period is expired. After this they become more or less agitated; and this state continues as long as the animal heat keeps tolerably high. On the last day they fall into a state of stupor, attended with a rapidly increasing weakness. The animal shakes when it stands, and seems giddy; the feet are cold and livid, and contracted like a ball. The respiration becomes more and more feeble and slow, and sensibly diminishes; the pupil of the eye dilates, and the animal dies, sometimes tranquilly, sometimes after a few spasms, or convulsive movements of the wings, or opisthotonos of the body.

The feculent discharges were, as already stated, copious on the first day, being the remains of the food, previously taken, but were small in quantity afterwards. During the last three days of life, however, they augmented in quantity, and presented the appearance of colliquative diarrhoea. The weight of these feculent discharges was intimately connected with the diurnal loss of weight, and, with the exception of the age, nothing appeared to possess a greater influence on the probable duration of life than the nature and quantity of this discharge; the duration of life and the quantity evacuated were always in the inverse ratio to one another.

The cerebral functions seem to remain entire till toward the end of life.

As M. Chossat's experiments led him to conclude that death eventually occurs from the cooling of the body below what is necessary for life, he was also induced to inquire whether an animal just expiring could be brought back to life and strength,

if it were plunged into an elevated temperature. The result was a favorable one. When placed in a heated stove, the animals gradually but slowly revived. The appetite returned, but digestion did not take place unless the temperature was kept up at its elevated point. This last, however, gradually regained its power, and thus the natural animal heat was restored. There were, however, exceptions to this, the animal dying, notwithstanding his partial recovery, after successive attacks of convulsions.*

Dr. Duncan remarks: "It was a matter of notoriety, when persons in health were deprived of their usual food, or when animals were starved for experiment, that the intestines were found inflamed and ulcerated; this circumstance has also been remarked in some recent cases of criminal trials for willful murder by starvation."†

As several of the signs enumerated are characteristic and peculiar, they will serve to exclude the other causes of violent death.

But there will be more difficulty in discriminating it from death through natural causes. The duty of the medical jurist in these cases, according to Mr. Taylor, consists—1. In determining that there has been no other probable cause of death. 2. In stating how far the pathological condition of the body coincides with the general evidence in favor of death from starvation. 3. *In not giving an opinion merely from the appearance of the body, if the general evidence should not support the presumption of death from starvation.*‡

In 1768, the daughter of a notary at Nevers, in France, aged fifteen, died of an unknown disease. She had been already buried, when it was rumored abroad that her father had caused her death by hunger. The information laid before the judge

* Annales d'Hygiène, vol. xxx. p. 457, and Edinburgh Med. and Surg. Journal, vol. lxi. p. 156. Casper reports a case of attempted starvation in a convict, who persisted eleven days in refusing food. His mind was not affected, and although the urine was nearly suppressed and the fecal discharge altogether so, yet the chemical qualities of the latter were not altered. He finally gave in, and gradually took food. (Encyclop. des Sciences Médicales, March, 1845; p. 189.)

† Lancet, N. S., vol. vi. p. 429.

‡ Med. Jurisprudence, p. 244.

was of such a nature that he directed the arrest of the parent, and the disinterment of the body. This was twenty-four hours after the burial. The report of the medical examiners was as follows:—

The whole body is extremely emaciated. The skin is very thin, and its color livid; an unpleasant odor is exhaled; the eyes are open and red; contusions and excoriations appear on various parts of the body; and the anus and vagina are covered with small white worms in great quantity, and these parts, and particularly the first, are much excoriated and dilated. On opening the body, the stomach was seen in a healthy state, containing a wineglassful of serous, greenish bile; the pylorus was contracted; the duodenum, together with the right side of the ileum and jejunum, was inflamed; the gall-bladder was swelled with bile, and the intestines were entirely empty. The remainder of the viscera, together with those of the thorax and head, were in a healthy state, except that the right lung was a little withered. The report concluded by giving an opinion that the girl had died in a state of extreme weakness and languor, but it assigned no cause.

Public opinion continued to implicate the parents, and they sought a defender in the celebrated Petit, from whom an answer to the following questions was requested: 1. Whether the facts stated above were sufficient to prove that the child died from hunger? 2. Whether there was any circumstance to indicate that a length of time had elapsed between the death and burial? To both these he answered in the negative, and for the following reasons: Extreme emaciation is rather a proof of long illness, than of starvation, because it is very common for persons of a tolerable degree of fatness, when they refuse food, to die before they lose much flesh. The emptiness of the intestines was more indicative of colliquative diarrhœa from long disease, than of any other cause. The state of the gall-bladder proved, in Petit's opinion, nothing on one side or the other, nor did the excoriations, while the natural state of the stomach was an argument against death by famine, since in such cases that organ is observed to be much contracted. Finally, the worms might have been present in the parts for some time before death, nor was the smell of the body by any means so

offensive as to indicate putridity of long standing. On these grounds, though unwilling to assign a cause of death, he was decidedly of opinion that famine had not induced the fatal termination.*

On the trial, it was conclusively proved that the parents had been guilty of maltreatment, and though after the opinion of Petit their lives could not be affected, yet the father was sentenced to the galleys for life, and the mother to perpetual banishment.†

"Starvation is rare as an act of homicide, but it must not be supposed that the law implies by this the absolute privation of food; for if that which is furnished to a person be insufficient in quantity, or of improper quality, and death be a consequence, malice being at the same time proved, then the offender equally subjects himself to a charge of murder."‡

C. Of persons found dead from lightning.

As to death by lightning, it may be remarked that it is usually distinguished by a variety of appearances. Sometimes the viscera are destroyed without any external mark being present, while in others there is nothing but a small hole. Again, there will be great external injury observed; but the

* In former editions I adopted the remark of Foderé, that in this case Petit appears as the advocate of the accused, not as an impartial investigator of truth. On further reflection, and principally in consequence of the animadversions of Mr. Taylor, I am disposed to cancel much of this censure. Still the case comes very nearly under the rules of Mr. Taylor as already quoted.

Petit would have been justified in stating that the morbid appearances did not prove the fact of death by starvation; but I can hardly, taking the general and medical testimony together, agree to the positive assertion that famine had *not* caused the fatal termination.

† Foderé, vol. iii. p. 223. In addition to the references on this subject, I may quote *Cyclopedia of Practical Medicine*, art. *Abstinence*, by Dr. Marshall Hall; *Copland's Dictionary*, art. *Abstinence*. A case by Mr. Griffith, *London Medical and Physical Journal*, vol. xliii. p. 99; *Percival's Essays*, vol. ii. p. 260; *Lancet*, N. S., vol. ii. p. 158; vol. iii. p. 486. Dr. Ogston's case of *Melanosis of the Stomach*, *Edinburgh Med. and Surg. Journal*, vol. xxxviii. p. 259. A case by Mr. Tompkins, in which the morbid appearances strikingly correspond with those given in the text. *Lancet*, N. S., vol. xxi. p. 904.

‡ Taylor's *Medical Jurisprudence*, p. 247.

most common accompaniments are discolorations of the skin, generally in the form of streaks. These are of a red color, and it has been remarked that they are peculiarly to be traced in the direction of the spine. Others again receive wounds, or the integuments are extensively burnt, and blisters form.*

The bodies of those killed in this manner are generally, but not always flaccid, and the blood is, on the authority of John Hunter, said to be fluid.

[Subsequent observation has not confirmed this very common opinion. "There is obviously nothing in the action of the electric fluid to retard or prevent the coagulation of the blood." Cadaveric rigidity has also been noted by Brodie and others.]†

As to the cause of death by lightning, two theories have been maintained. John Hunter supposed that there was an instantaneous and total destruction of the vital principle in

* In illustration of this, I may refer to the following—the case of Mr. Bodington and his lady, both struck by lightning, in England. The injuries received by her were actual wounds, while his were only burns. (London and Edinburgh Philosophical Magazine, vol. i. p. 191.) Very extensive burns, with a raising of the epidermis. (Edinburgh Medical and Surgical Journal, vol. xli. p. 493.) The epidermis nearly destroyed, and the hair burnt, a French case. (Lancet, N. S., vol. vi. p. 910.) Two German cases, one with livid streaks, and the other extensive burns. (Lancet, vol. vii. pp. 255, 445.) Extensive blistering of the skin. (New York Medical and Surgical Register, p. 55,) case by Professor Stevens. Extensive and numerous burns and all the clothes in rags, while the boots were torn in pieces. (Lancet, N. S., vol. xxiv. p. 681.) In an instance of five persons struck, and three instantly killed, no mark of external injury was found on two of these, and on the third, only a burnt spot of the size of a dollar under the right axilla. In the fourth, who recovered, there was an abrasion of the skin on the right shoulder, her clothes were rent into shreds and the right side of the body was blistered and marked by discolored streaks. (Le Conte, in Forry's New York Journal of Medicine, vol. iii. p. 296.)

"It is the opinion of medical jurists that the electric fluid does not produce burns on the body unless some parts of the clothes be ignited, and then, of course, the burning is an indirect result. In cases that have been carefully observed, where the dress of the individual has escaped combustion, the wound produced which had penetrated beyond the surface presented merely the characters of lacerated punctures, exactly resembling stabs with a blunt dagger." (Review of Nicolai, in British and Foreign Medical Review, vol. xvi. p. 74.)

† See London Med. Gazette, vol. xxxviii. p. 351; also, vol. xlvii. p. 844; Lancet, N. S., vol. xxxi. p. 864.

every part of the body, and consequently that the muscles are relaxed, and incapable of contraction. Hence their flaccidity, the fluidity of the blood, and a rapid tendency to putrefaction. Mr. Brodie, on the other hand, concludes from his experiments that this does not take place, but that in a majority of cases the effects of lightning are expended chiefly in disturbing or destroying the functions of the brain. He found the heart acting in an animal apparently dead from an electric shock.

In this way, also, he explains the many symptoms imitating apoplexy or affections of the head which arise from injury of this nature.*

In making up an opinion in a doubtful case, much depends on the place and situation where the body is found. If a person be dead in an open place, or under a tree, shortly after a thunder-storm, with the appearances now enumerated, we may attribute his death to lightning, and particularly so if any metallic substances about him are found melted, and his clothes torn or burnt, while dissection exhibits nothing adverse to the idea.†

* Thus, Dr. Macauley (Edinburgh Medico-Chirurgical Transactions, vol. i. p. 360,) found apoplexy to succeed, with all its external appearances, and in two other cases, epilepsy. Mr. Godfrey, surgeon of the Cambrian, (London Medical and Physical Journal, vol. xlvii. p. 369,) relates of a sailor struck dumb and blind. Deafness is not at all an uncommon result; so also, paralysis. Dr. Young (American Journal of Medical Sciences, vol. xiii. p. 54,) and Dr. Stevens both observed dilated pupils.

† Many cases of death or injury by lightning, together with the appearances observed, are to be found in the Philosophical Transactions. See vol. i. pp. 222, 247; vol. v. p. 2084; vol. xix. p. 311; vol. xx. p. 5; vol. xxi. p. 51; vol. xxii. p. 577; vol. xxvi. p. 137; vol. xxxiii. p. 366; vol. xxxiv. p. 118; vol. xxxvi. p. 444; vol. xlviii. p. 86; vol. li. p. 38; vol. lii. p. 515; vol. lxii. p. 131; vol. lxiii. pp. 177, 231; vol. lxvi. p. 493; vol. lxxi. p. 42; vol. lxxvii. pp. 61, 130; vol. lxxx. p. 293. There is also an interesting account of the celebrated death of Richman, at St. Petersburg, vol. xlix. p. 61. Another, of Lomonosoff, will be found in Dr. Granville's Travels to St. Petersburg, vol. ii. p. 112. There was only a red spot on his forehead, the legs were blue, and one shoe was torn, but not burnt. [In a case given in Henle's Journal, one hemisphere of the brain was completely disorganized, and the left lung partially injured. Taylor, p. 544.]

I find the following in the works quoted below:—

On Death from Lightning.—By Professor Carussi. Read at the Scientific Congress, held at Turin, in September, 1840.

Professor Puccinotti, in his Treatise on Legal Medicine, announces a sign of

D. Of persons found burnt to death.

The same circumstances to which we have directed the attention of the examiner in previous sections, are to be noticed in cases of this nature. Dissection must not be omitted.

There is an instance related by Foderé, which presents a most instructive lesson. In 1809, a wretch murdered several individuals with an axe, and then set fire to the house. The medical officer did not deem it worth while to examine the bodies, and certified that their death was owing to the fire. Meanwhile an individual was discovered murdered about one hundred paces from the house, and suspicion being excited, the bodies were disinterred. It was found that the flames had only burnt the flesh superficially, and that the marks of the axe were still distinctly visible.*

death from lightning, which is not imitable by human malice, and may therefore be considered as pathognomonic.

The eyes of those who are killed by lightning are found brilliant and protruding, so that the eyelids cannot be closed over them. It is exactly in the two lateral segments of the albuginea thus left open that the sign in question is observed, and which may be considered as a sanguineous capillary infiltration, or an electrical burning. It consists in dark bloody spots, of a conical form, and much resembling an inverted pterigium. They occupy the side of each eye, with their basis toward the iris and their acute angles corresponding to the internal and external angles of each eye.

This mark of death from lightning is usually accompanied with an injury of the epidermis resembling a burn. Small portions of it are found separated and rolled up and crisp, and sometimes wounds of an oval shape are noticed, passing from right to left in an oblique direction, and extending into the subcutaneous cellular tissue.

Professor Puccinotti is disposed to attach equal importance to both of these signs as characteristic of this kind of violent death. Not so, however, with Professor Carussi. In three cases seen by him at different times, the dark bloody spots in the eyes were invariably present, but the injuries to the epidermis of the wounds were wanting. In one case only there was on the back of the right arm an apparent hardness and scorching of the skin, surrounded by an areola. Its size was about an inch, and its shape quadrangular. (*Archives de la Médecine Belge*, vol. iv. p. 217.)

* Foderé, vol. iii. p. 18. Dr. Dunlop (MS. Lectures) mentions a similar case occurring at Glasgow, in 1809. A man murdered his wife, and then set fire to her clothes. There were, however, marks of external violence, sufficient to convict him.

So also in the State of Maryland, a few years since, a ruffian murdered a whole family, and then fired the log-house in which they lived. On the body of the father, however, a fracture of the skull was found; and in consequence of a bed from the upper room falling on the mother, her body was so far uninjured as to exhibit three incised wounds, one of them penetrating the stomach. The murderer was detected by finding on him articles of dress belonging to the family.

Apart from the possibility of such cases, it not unfrequently becomes necessary to ascertain whether the burning has happened during life. A person may have been strangled, and the clothes subsequently fired, to present the appearance of accidental death.

A case bearing on this point occurred some years since to the late Dr. Duncan in Scotland. A husband and wife, living on bad terms, were heard to struggle, and after a short time the neighbors were alarmed by a strong smell of fire. All attempts to enter were for some time fruitless, owing either to the real or pretended deep sleep of the husband. At last, on obtaining admission, the body of the female was seen burning on the hearth. On examination before the coroner, the abdomen was found reduced to a cinder, but on the face and extremities there were marks of reaction; some spots were red and inflamed; others scorched to a hard and transparent crust, but surrounded with distinct redness; and "a great many blisters filled with lymph, perfectly different from those produced on the dead body, which are not filled with a fluid, but with air or vapor. In short, we found," says Dr. Duncan, "appearances exactly similar to those of fire on a living body, and therefore we reported, as our unanimous opinion, that the deceased was burnt to death."

As there was no proof that the prisoner had been the cause, he was not found guilty; and it is indeed possible (although there were some suspicious circumstances against him) that this may have been a case of preternatural combustibility, as I shall hereafter describe it. Such, indeed, is Prof. Christison's opinion; a part of the clothes were unburnt; the chair from which she had fallen was entire, and yet the abdomen was nearly destroyed.

However this may have been, the present case appears to have led Prof. Christison to perform an interesting series of experiments, in order to ascertain the criteriæ by which a burn, inflicted during life, may be distinguished from one produced after death.

From his observations, it follows that "the only effects of burns which appear immediately after the injury, and remain in the dead body, are—*First*, a narrow line of redness near the burn, not removable by pressure; and *secondly*, blisters filled with serum; that the former is an invariable effect, but that the latter is not always observable when death follows the burn in a few minutes."

In order to meet the inquiry which readily suggests itself, "whether these appearances can be produced or imitated immediately after death, while vitality still lingers in the body, or to use Bichat's phrase, while organic vitality survives the extinction of animal life?" Prof. Christison performed several experiments.

In a stout young man who poisoned himself with laudanum, a very hot poker and a stream of boiling water were applied to the skin of the chest, and inside of the arm, one hour after death. On the next day, no blisters or redness were visible on or near the burns. At the parts burnt with scalding water, the cuticle appeared as if ruffled, and could be very easily rubbed off, but there was not a trace of moisture on the true skin beneath. At the parts burnt with the poker, the whole thickness of the skin was dried up, brownish, and translucent, but entirely free of redness or blistering on or around them.

In another case of poisoning, where the patient was comatose, heat had been applied four hours before death, and again was applied half an hour after it. The body was examined in thirty-eight hours. Some of the spots burned during life presented a uniform blister filled with serum; and even where the cuticle was gone, and the true skin dried, there were drops of serum, and also particles of the same fluid dried by evaporation; around all of them, also, there was more or less scarlet redness, and this redness was not diminished by pressure. Some of the spots burned after death, were charred on the surface, and not elevated; two presented vesications, but the blisters were filled

with air; the cuticle over them was dry and cracked, and the surface of the true skin beneath was also quite dry. On the white parts of the skin there was no adjacent redness, and the lividity which occurs in dead bodies was immediately removed by moderate pressure.

These, and other experiments with similar results, led Prof. Christison to the conclusion that the application of heat to the body, even a few minutes only after death, cannot produce any of the signs of vital reaction mentioned above; and he concludes his observations by remarking "that, as far as the preceding experiments go, a line of redness near the burn not removable by pressure, and the formation of blisters filled with serum, are certain signs of a burn inflicted during life."*

As the medico-legal cases on this branch of my subject are far from numerous, I will here add the details of one which recently occupied some attention in France.

On the 10th of July, 1834, at 4 A. M., Ursula Lambert Berenger was found dead in her room. The body, completely naked, lay in the fire-place. The head, reclining on the left temporal region, was in the centre of the hearth, the rest of the body was without the fire-place. The head and neck were burnt almost to a cinder. The left arm was little injured, but the right was so disorganized by the action of the fire that the phalanges of the fingers were nearly detached. The abdomen was much distended, the epidermis detached in several places, and phlyctenæ, full of a red serum, occurred here and there. The rest of the body presented nothing particular except the effects of a passing burning substance. The blisters were also noticed on the left knee. No scratching or wounding was observable on the knees, insteps, or any other part.

The husband had been on bad terms with his wife; he cohabited with another female, and it appeared that recently he

* Edinburgh Medical and Surgical Journal, vol. xxxv. p. 320. The appearances found in persons who die from burns and scalds are enumerated by Mr. Samuel Cooper, in a Clinical Lecture, published in the London Med. Gazette, vol. xxiii. p. 837. There is a paper in the Medico-Chirurgical Transactions, vol. xxv., showing the tendency to acute ulcerations of the duodenum, in cases of extensive burns; and the inquirer can also consult Erichsen on the Pathology of Burns, in London Medical Gazette, vol. xxxi. pp. 544, 558.

had endeavored to strangle her. Suspicion of murder was therefore natural.

From the testimony of Dr. Seguy, the medical examiner, the following facts are obtained:—

The fire appears to have been small, the remains of it (two stumps) were still to be seen. Near it was an earthenware coffee-pot, turned over. No other marks of struggle or disorder were manifest about the room.

After removing the body to a more convenient position, fragments of the chemise, in which alone she had been dressed, were found under all parts of the body immediately in contact with the floor, such as the elbow, hip, and left knee. The remaining articles of clothing were on a chair near the bed.

The left arm was found bent, and the hand on the precordial region. The right also was bent, and in front of the chest, so that the right hand touched the left clavicle. The legs were half bent, the face was completely carbonized, the ears horny, the skin black and dry, except at the left temporal region, where there was a quantity of hair enveloped in an enormous mass of coagulated and sodden blood. This led to an examination of the ashes, and they were found moist at the place where the head had lain. The tongue was shortened and shriveled. The integuments on the neck and arms were hard, cracked, and of a black color. So, also, those of the breast, back, and shoulders, but of a less black color. The other parts were not marked with a red circle, nor were any blisters to be seen, except those already noticed.

On examining the brain, no indications of external injury were perceived. Strong adhesions of the membranes were present, and the sinus of the dura mater was filled with black blood. The convolutions of the left lobe of the brain were covered with sodden blood, and the portion of it at the temporal region and the base of the brain was reduced to a *bouilli*, while the correspondent part only exhibited a full injection of the vessels. The left lobe internally was hard, brownish, and covered with a number of deep-red spots. The right was natural, but its internal substance was extremely red. The ventricles contained a bloody serum.

The lungs were hepatized, gorged with blood, and the bron-

chia contained a reddish mucus. The stomach and intestines, though much distended with gas, were natural.

In testifying on the facts of this case, Dr. Seguy advanced the opinion that Mrs. Lambert had died of apoplexy. The manner in which this was caused was more difficult to be solved. He does not suppose that it happened from compression of the vessels of the neck, (strangulation.) But if not thus, was she seized with syncope, while preparing tea for herself, and did she then fall into the fire, or did she cease to live before she was placed on the fire?

By applying Dr. Christison's proof of burns inflicted during life, it will be seen that there was no redness or blisters around the neck or chest, while the latter occurred on other parts. Again, admitting that syncope or even apoplexy supervened at the moment when she fell into the fire, some vital action or exertion must still have been made, which would have produced some disorder around the fire-place, or at least some excoriations on the knees and feet. These were, however, wanting.

In favor of death before the burning, are the possibility of a rupture of blood-vessels in the head, causing compression, the engorgement of the lungs and their hepatization, the want of vital action around the burns, and the certainty that there had been no vital resistance, and that the head had not been displaced from its original position.

On the other hand, are the possibility of sanguineous effusion from the action of fire, the presence of blisters, and the possibility that these and other vital phenomena could not be developed in the other parts of the body in consequence of the prolonged action of the fire.

Dr. Seguy inclined to the idea of murder, (that she had been the victim of two crimes,) that the apoplexy was not a natural one, that hemorrhage succeeded it; and finally, when pressed for a direct and positive answer, he gave it as his opinion that the individual was dead before her body was submitted to the action of fire.

Dr. Accarie, another medical witness, denied that strangulation could produce apoplexy, but that it caused asphyxia, owing to the want of vital air. He deemed it possible that the deceased had died instantly from apoplexy while in the

supposed position, and cited analogous cases. In such, apoplexy is frequently unaccompanied with convulsions, and consequently no effort will be made. It is evident that the chemise was burnt while she had it on, and Dr. A. supposed the fire to have commenced at its bottom, thus explaining the blisters and redness on the abdomen and left knee. This, he presumes, caused violent agitation, and apoplexy was the result. Hence the absence of those marks on the upper parts, since life was extinct. As to the rigidity of the limbs, he remarks: "La rigidité cadaverique se manifeste d'autant plus tard que la mort a été plus rapide: c'est le cas de l'apoplexie."

The blood soiling the hair of the left temporal region, and the quantity found, prove that it had issued out before the burning commenced, since the ears did not escape its destructive action, and in cases of apoplexy, it is well known that the blood often issues from the ears, nose, mouth, and eyes.

The absence of all excoriation on the knees proves that there has been neither contest nor resistance.

The inflation of the abdomen is, doubtless, owing to the action of the fire, and to commencing putrefaction.

The adhesion of the membranes of the brain, their sanguineous injection, the fullness of the sinus of the dura mater, the presence of blood in the convolutions of the brain, resembling a clot, the bloody serum in the ventricles, the interior hardness of the left lobe, and the many red spots in the medullary substance, all these being the result of chronic or acute inflammation of the brain and consequent congestion, may be attributed to *foudroyante* apoplexy, rather than to the action of fire alone, or to strangulation first and then fire. Indeed, the violent action of caloric produces different effects. Bichat, in his experiments with boiling water, to which he submitted a human head, found such a contraction of the dura mater, that the brain, which did not harden, burst it.

Esquirol says that in strangulation the head sometimes exhibits no marks of strangulation, and the lungs and heart are empty of blood.

Dr. A. accordingly arrived at the following conclusions: 1. That death did not result from strangulation. 2. That the internal appearances in the brain are owing to apoplexy, and

that the combustion caused a roasting (*coction*) of the effused blood. 3. That it is highly probable that Berenger died of apoplexy.

A third physician, Dr. Girodet, was called to explain the discrepancies between the two witnesses. He asserted that strangulation *sometimes* produced rupture of the blood-vessels of the brain, and also said that a blow, for example, the traces of which *might* have been destroyed by fire, could have caused the apoplexy.

Dr. Seguy relied much on Dr. Christison's proofs of burning during life. Dr. Accarie, on the other hand, undervalued them, remarking that the red circle must be effaced after death, as happens in erysipelatous patients, where the redness disappears when the individuals die.

The jury found the husband, Berenger, guilty, but with extenuating circumstances, and he was condemned to ten years imprisonment at hard labor.

Dr. Leuret, the reporter of this case, in his comments, observes that several modes of death are nearly equally admissible.

1. *Natural Death.* It is possible that apoplexy may have seized her when near the fire, and that she fell on it, and that the combustion, supposing it continued after her death, may have destroyed the parts which contained the red circles produced during life. The presence of blisters on the parts touched by the burning chemise shows the action of caloric on the living skin. The experiments of Christison, however, are not invariable. Dr. Leuret has seen large blisters, filled with a reddish serum, form in large numbers on a body twenty-four hours after death. He applied a chafing-dish of charcoal to the legs of an infiltrated (dropsical) body. The epidermis hardened a little, became elevated, and below it was an abundant collection of reddish serum. On applying the chafing-dish to other parts, the same result occurred. He repeated the experiment on bodies not infiltrated, and no blisters arose. But as Dr. Seguy does not say that this body was infiltrated, and as indeed he remarks that on the evening of her death this female was in good health, Dr. L. allows that the blisters on the abdomen were the result of burning during life.

2. *Death by Strangulation.* We cannot affirm or deny it.

The heart and blood-vessels were not examined. It is possible, but it is not proved.

3. *Death by Blows on the Head.* Under this supposition, the body must have been thrown into the fire before the complete extinction of life, and the assassin, desirous of obliterating all marks of wounds, would place the stricken side on the fire.

4. *Death by Cerebral Congestion or Syncope.* If we admit this kind of death, we must ascribe the sanguineous effusion to the action of fire on a body still warm. Bichat's experiments are not applicable. He used boiling water, while this was the direct action of fire. Dr. Leuret, in his experiments, was not able to produce anything analogous to the present case on the supposition now under consideration. In conclusion, he observes that the absence of all external marks of violence are presumptive evidence in favor of its having been a natural death.*

There is another question that may arise in cases where persons are found burnt to death, which is alike interesting and curious; and that is, *Can there be such a thing as PRETERNATURAL COMBUSTIBILITY OF THE HUMAN BODY?*† Several cases are recorded of this nature.

[The murder of the Countess Gorkitz, in 1847, brought this subject again and with fresh interest before the public. On this case conflicting opinions were given by the medical men who

* *Annales d'Hygiène*, vol. xiv. p. 370. "Murder by burning is very rare. A case, however, occurred at Truro, some years ago, where it was suspected. A dissolute woman had locked up her child in her room alone, where it was found burnt to death some hours after. On accurate examination by Dr. Barham, in conjunction with Messrs. Bulmore and Spry, some portions of the tinder were discovered in the lower part of the windpipe. These must have been drawn in with the breath during the last moments of the child, whose mouth and face had evidently been enveloped in the burning clothes. Dr. Barham adds, this was the principal circumstance which prevented the committal of the mother for murder." It is well asked by the editor, whether a murderer might not have wrapped the child's face in its clothes. (*London Med. Gazette*, vol. xxxiii. p. 316.)

† In a former edition, I used the term *spontaneous combustion*, to express this phenomenon; but as that takes for granted what it denies by many, I have preferred the present appellation, the correctness of which I believe will not be denied by any who have examined the accumulated testimony on the subject.

first examined the body, and although it very soon became manifest to all parties that the Countess was murdered, and an attempt subsequently made to burn her body, yet Liebig and Bischoff went out of the case before them to deny the possibility of spontaneous combustion, even in the modified sense in which it is now held, *i. e.*, preternatural combustibility of the human body, and to deride those who hold that doctrine. The gauntlet thus thrown down was frankly taken up by Devergie, and the *Annales d'Hygiène* for 1850-51, *et seq.*, were crowded with essays, reports, &c. This seems to have drawn popular notice to the subject, and a popular novelist having killed off one of his characters in this way, was sharply taken to task by a weekly periodical for giving countenance to such an absurdity.* A flippant article in *Blackwood*, 1860, derided, in humble imitation of the great Germans, those who clung to such antiquated superstitions. It seems proper, under these circumstances, to present the subject in all the light which these modern researches and arguments have thrown upon it. This I think can best be done by giving a type case of those which are relied on by the advocates of the doctrine, to be followed by a pretty full report of the case of Gorlitz, and in selecting the type case, I take that reported by Devergie as one of the most recent and best authenticated.

Mad. Bally, aged fifty-one, a washerwoman, lived in Paris, *Quai de l'Ecole*, 4th story, occupying a small chamber eight or nine feet long by five or six wide, partition wall of wood, which had two narrow windows opening on a corridor. The only furniture of this room was a chest in one corner, a chair, and muslin curtains to the windows. There was no bed. On the evening of Dec. 29, 1829, this woman returned to her room very drunk. At eight next morning the neighbors, alarmed by a smell of smoke, entered the room; they found the body of Bally lying on the floor, the feet towards the chimney, in which there was no fire. Under one arm was a bar of the chair upon which she had been seated, and beneath her was an earthen foot stove (*gueux*) and a few cinders of the burnt chair. The floor was covered with a black soot. A beam in the wall was slightly charred. The chest was not scorched nor the

* Dickens' *Bleak House* and the *London Leader*.

muslin curtains burned. The body was taken to the Morgue and there examined by M. Devergie, the Medical Inspector of the Morgue. He found the face, the hair, the front of the neck and shoulders untouched by fire, but the skin on the back and thighs was entirely destroyed. There remained no vestige of it. The muscles of the back, loins, both sides and the front of the body were grilled, horny, and reduced to one-eighth part of their size. The coccyx and the greater part of the sacrum were charred and greasy to the touch, as were the ribs, though in a less degree. The iliac bones were deprived of their muscles. Of the upper extremities there remained only bones and some shreds of tendon. The lower extremities were burned only in their upper third. The anus and vulva were untouched. The stockings were unchanged. Such was the case of the woman Bally, reported by Devergie. We will now present that of the murdered Countess. On Sunday, June 13, 1847, the Countess of Gorlitz, a lady aged forty-six, very temperate, of active habits and enjoying very good health, retired to her apartment, as was her custom, to take her siesta. These apartments were a principal chamber 15 ft. 3 in. by 13 ft. 10 in., 13 ft. 4 in. high, an ante-room communicating with the larger, and a small closet. The chief articles of furniture in the principal chamber were a large secretary with drawers containing many combustible articles. There was in the N. W. corner of the room a small stove, in the N. E. corner a sofa, at a distance of 12 feet south of the secretary a mirror over the sofa, the glass of which was $\frac{1}{4}$ inch thick. In the evening the doors were broken open and the body of the Countess found partly consumed in the midst of articles of furniture still burning. The room was filled with thick, black, empyreumatic smoke. The secretary was burning, and the flames had communicated to the curtains. The lower part of this secretary was almost entirely gone, the floor beneath and in front of it for a space of $1\frac{1}{2}$ feet was burned through, the beams below beginning to kindle; marks of fire were found on the sofa,* several metallic articles about the secretary were melted; stearine candles at distances of from 9 to 27 feet were melted. The frame of the mirror was so hot that

* Several chairs, more distant from the secretary than the body, were more or less burnt.

it could not be touched. In the midst of these proofs of fierce and active combustion the body of the Countess was found resting on the side, the feet towards the secretary, the legs bent, the arms slightly stretched out. The head was so burned as to appear a charred mass the size of the double fist. The neck burned all round, though not as much diminished in size as the head. On the anterior part of the chest the skin was burned off, the exposed muscles dark brown, the arms charred from the tips of the fingers to the shoulders, yet the tissues were all distinguishable.

As to the cause of this fire we now know by the confession of the culprit, that she was strangled by a servant whom she detected stealing, and that he placed the combustibles around her and fired them, hoping to destroy the evidences of his crime. In the course of the investigations and experiments to which this case gave rise, it was calculated that in the room of the Countess seven cubic feet of wood, ninety-four pounds, were consumed. Now comparing these two cases, is it possible to resist the conclusion that the body of Bally was more combustible than that of the Countess? Liebig and Bischoff evidently think it is not, for they deny the facts. The human body, say they, is incombustible—no scientific man has seen the combustion—the records are fables. So Casper, in his Medical Jurisprudence, says: "It is sad to think that in an earnest scientific work, in the year of grace 1861, we must still treat of the fable of spontaneous combustion, a thing that no one has ever seen or examined, the very proofs of whose existence rest on the testimony of perfectly untrustworthy non-professionals! Every truly experienced medical jurist must regard the hypothesis of spontaneous combustion as one of the silliest of fables." Now let us ask a question in our turn. Is it possible that in the year of grace 1827, an Aggrégé Professor of the Parisian School of Medicine, the Medical Inspector of the Morgue, should have published the case of Bally, pretending that he had with his own eyes examined the body and the room from which it was taken, and that the whole story, though a "*silly fable*," has never been contradicted or brought in doubt? To those who know the watchful jealousy with which the actions of every rising man are scrutinized in such a community as

Paris, this will appear quite as great a marvel as spontaneous combustion.*

This subject cannot be better summed up than in the words of Grey (Med. Jur., p. 383): "The cases on record may fairly be allowed to prove an unusual combustibility of the human body, occurring in rare instances, and, for the most part, in corpulent, spirit-drinking females, merely requiring to be set on fire, and needing no other fuel but their clothes or night dress. Till we possess cases better authenticated, and more accurately reported, we must content ourselves with this amount of knowledge."—C. R. G.]

* Lair, p. 162, who quotes the Annual Register for 1763. See also Philosophical Transactions, vol. xliii. p. 447.

The reader desirous of further information on this curious subject is referred to Lair's Essay, *passim*; Philosophical Trans., vol. xliii. p. 463; Foderé, vol. iii. p. 208, and to the following reported cases:—

1. Mary Clues, aged fifty, at Coventry, England; Wilmer, Philosophical Transactions, vol. lxiv. p. 340.

2. An anonymous case by Vicq. d'Azyr, of a woman aged fifty years.

3. A case by Henry Bohanser, of a female at Paris.

4. The wife of Sieur Millet at Rheims, in 1725, related by Le Cat.

5. Mary Jouffret, at Aix, in Provence, related by Murair, a surgeon, in the Journal de Médecine.

6. Mademoiselle Thuars, at Caen, in 1782, related by Merille, a surgeon, in the Journal de Médecine.

7. Two anonymous cases of females at Caen.

All these are mentioned by Lair.

8. An anonymous case of a female at Paris, in 1779. Foderé, vol. iii. p. 207.

9. The Priest Bertholi, in 1776, in Italy. This is a very remarkable case, and some particulars mentioned by Battaglia, the surgeon who attended him, may with propriety be added in this place. Bertholi was travelling about the country, and at evening arrived at the house of his brother-in-law. He immediately desired to be shown to his apartment, and when brought to it, requested that a handkerchief should be placed between his shirt and shoulders. This was done, and he was left to his devotions. A few minutes had scarcely elapsed before a noise was heard in his room, and the cries of the priest were particularly distinguished. On entering the room, he was found extended on the floor, and surrounded by a light flame, which receded as they approached, and finally vanished. On the next morning M. Battaglia was called, and examined the patient. He found the integuments of the right arm almost entirely detached from the flesh, and between the shoulders and thighs the integuments were injured. There was a mortification of the right hand, and this, in spite of scarification, rapidly extended itself. The patient complained of burning thirst, and was horribly convulsed; he passed by stool putrid bilious matter, and was exhausted with continual vomiting,

Some deductions are drawn from these cases by Drs. Lair and Marc, which it is proper to mention. 1. The subjects

accompanied with fever and delirium. On the fourth day, after two hours of comatose insensibility, he expired; and a short time previous to his death, M. Battaglia observed, with astonishment, that the body exhaled a most insufferable odor—worms crawled from it on the bed, and the nails had become detached from the left hand.

The account of the patient was, that he felt a stroke like the blow of a cudgel on the right hand, and at the same time saw a bluish flame attack his shirt, which was immediately reduced to ashes, the wristbands in the mean while remaining totally untouched. The handkerchief between the shoulders and shirt was entire, and free from any trace of burning. His breeches were also uninjured, but though not a hair of his head was burnt, yet his cap was entirely consumed. There had been no fire in the room, except that the lamp, which had been full of oil, was now dry, and its wick reduced to a cinder. Foderé, vol. iii. p. 210. London Medical Repository, vol. i. p. 332.

10. A female at Paris, in 1804, aged sixty-eight, related by Dr. Vigné. Foderé, vol. iii. p. 216.

11. A female in France, aged twenty-eight, communicated by Dr. Prouteau, in Leroux's *Journal de Médecine*. New England Journal, vol. iv. p. 194.

12. Mrs. Laire, at Saulieu, in 1808, aged sixty. Ballard, p. 414.

13. Ignatius Meyer, aged forty-eight, in the village of Waertelfeld, in Germany. London Medical Repository, vol. iii. p. 239. New York Medical Repository, vol. xviii. p. 87.

14. Mrs. P., aged ninety, and her servant, aged sixty, at Nevers, in France, on the 15th of January, 1820. Case by Dr. Charpentier, London Medical and Physical Journal, vol. xlv. p. 347.

15. M. Vatin, at Beauvais, France, aged upwards of sixty. This happened in January, 1822. Edinburgh Medical and Surgical Journal, vol. xix. p. 653; vol. xxii. p. 233. American Medical Recorder, vol. vi. p. 764.

16. Margaret Heins, at Hamburg, January, 1825. This case somewhat resembles Bertholi's. From Hecker's *Annalen*. Edinburgh Med. and Surg. Journ., vol. xxvi. p. 215.

17. Mrs. Soret, aged fifty-seven, in December, 1825; occurred at Rouen, and related by Dr. Hellis. *Medico-Chirurgical Review*, vol. ix. p. 544.

18. A case of combustion of both hands, from attempting to extinguish the clothes of a brother, which were on fire. A blue flame continued for several hours over the parts, and it required constant immersion in water to extinguish it. Dr. De Brus, in *Archives Générales* for March, 1829. Edinburgh Med. and Surg. Journal, vol. xxxii. p. 227.

19. A female at Lexington, Kentucky, November 15, 1829. Case by Prof. Short, *Transylvania Journal*, vol. iii. p. 143.

20. Four cases in Ireland within the present century; two in Dublin, one at Limerick, and the other at Coote Hill, County of Cavan. All were females and intemperate. Related by Dr. Apjohn. *Cyclopedia of Practical Medicine*, art. *Combustion, spontaneous*.

21. The case of Jane Lappiter, an aged woman, *very temperate*, occurring at

were nearly all females, and they were far advanced in life. The Countess of Cesena was sixty-two, Mary Clues fifty-two,

Cheltenham, England, a few years since, is related by Dr. Newell, in *Midland Medical and Surgical Reporter*, vol. i. p. 248. A portion of the bones and the whole of the viscera were reduced to ashes. The fire extended to within about three inches of the ankle-joint, and yet neither the shoe, the stocking, nor the skin and flesh below were injured.

22. For the following American case, we are indebted to the researches of William Dunlap, Esq., of New York. Finding a brief reference to it in his interesting *History of New York*, I wrote to him for the particulars, as well as the authority on which he stated it. In his reply, he furnished me with the following from *Holt's New York Journal* of January 3, 1771, and *Gaines' Mercury* of January 7, two newspapers at that time published in the City of New York.

Hannah Bradshaw, aged about thirty, had lived about a dozen years in the city. She was a healthy, hearty-looking woman, remarkably industrious, and neat in her person and manner of living, but bore a bad character with respect to chastity and sobriety. On account of her robust appearance and bold behavior, she had obtained the name of *Man-of-war Nance*. She resided in an upper room, which had no connection with the rooms below, occupied by a family.

On the evening of the 31st of December, she desired a young woman who worked for her, and was going home, to come again early the next morning, and about seven o'clock the same evening another acquaintance parted from her, at which time she seemed to have drank a little too freely. She was neither heard nor seen again until the next morning, when the young woman returned to her work; after knocking and calling, and having waited until past eleven o'clock, this person, by the aid of a man who lived below, got in through a back window, and opened the door. On looking within a screen, which went quite across the room and was fitted to reach the ceiling, she discovered the mutilated remains of Hannah. The body, or rather the bones, were lying near the middle of the floor, wherein a hole of about four feet in diameter was burnt quite away, and the bones were at its bottom, about a foot beneath that part of the floor. The flesh was entirely burnt off the bones of the whole body, except a small part on the skull, a little on one of the shoulders, the lower part of the right leg and foot, which was burnt off at the small, almost as even as if cut off, and left lying on the floor. The stocking was burnt off as far as the leg, and no farther. The bones, some of which were black, and others white, were so thoroughly burnt as to crumble to dust between the fingers. The bowels remained unconsumed. One of the sleepers, which lay under the shoulders, was burnt almost through: part of the head lay in the planks at the edge of the hole, and near it was a candlestick, with part of a candle in it, thrown down, but it did not appear to have touched any part of the body or to have set anything on fire. The tallow was melted off the wick, which remained unscorched by the fire, as also the screen, which almost touched the hole. The leg of a rush-bottomed chair, and about half the bottom, were burnt so far as they were within the

Grace Pett sixty, Madame de Boiseon eighty, and M. Thuars more than sixty. 2. Most of the individuals had for a long time made an immoderate use of spirituous liquors, and they were either very fat or very lean. 3. The combustion occurred accidentally, and often from a slight cause, such as a candle, a coal, or even a spark. 4. The combustion proceeded with great rapidity, usually consuming the entire trunk, while the extremities, as the feet and hands, were occasionally left uninjured. 5. Water, instead of extinguishing the flames which proceeded from the parts on fire, sometimes gave them more activity. 6. The fire did very little damage, and often did not affect the combustible objects which were in contact with the human body at the moment when it was burning. 7. The combustion of these bodies left, as a residuum, fat fetid ashes, with an unctuous, stinking, and very penetrating soot. 8. The combustions have occurred at all seasons, but most frequently in winter, and in northern as well as southern countries.*

[Various explanations of these extraordinary facts have been suggested, as alcoholic impregnation by Lair and others; the agency of electricity by Le Cat, Kopp and others; accumulation of inflammable gases in the cellular tissue by Marc; the

compass of the hole on the floor, and no farther. The ceiling of the room, which was whitewashed plaster, was as black as if covered with lampblack, as also part of the walls and windows; and the heat had been so great as to extract the turpentine from the boards and the wainscot. After all these operations, the fire went entirely out, so that when the body was found not a spark remained.

23. A female, aged seventy-four, at Aunay, in the department of Avalon, France. *Medico-Chirurgical Review*, vol. xxix. p. 577.

24. Bernard, aged seventy-three, and his wife, aged sixty-five. *Medico-Chirurgical Review*, vol. xxx. p. 500.

25. Maria Bally, in Paris, aged fifty-one. The case occurred in December, 1829, and was examined and is reported by Devergie, vol. ii. p. 278.

26. Theresa Lemaitre, in Paris, on the 15th of December, 1836. She was sixty years old, and very intemperate. Related by Dr. Patrix, in *Lancette Française*. *British and Foreign Medical Review*, vol. iv. p. 222.

27. The case of a Moor at Algiers, reported by Dr. Lievin, in the *Journal des Connoissances Médicales*. *Medico-Chirurgical Review*, vol. xxxviii. p. 235.

28. A case from the *Gazette Médicale*, 1847, which I shall presently notice.

* Lair, p. 171; Foderé, vol. iii. p. 217.

formation of new and highly inflammable products by Julia Fontenelle; the generation of phosphuretted hydrogen by Prof. Apjohn; the accumulation in the tissues of habitual drunkards of the phosphorus which, in the shape of phosphoric acid, is in healthy persons eliminated by the kidneys. The objections to these hypotheses are obvious. 1st. It is impossible so to impregnate flesh with alcohol as to render it inflammable; as to the agency of electricity or the formation of new inflammable products, or the non-elimination of phosphorus, there is not a particle of proof of either: they are mere guesses, and not very probable at that. It is by showing the futility of all these theories that Liebig and Bischoff try to support their denial of the possibility of spontaneous combustion. To their argument that spontaneous combustion cannot be explained by any known chemical or physical law, M. Devergie replies with equal shrewdness and politeness. "Who is to assure us that you, M. Liebig, will not to-morrow discover a chemical or physical law that will explain our facts?"]

We are authorized in asserting, both from the history of ancient nations who employed this mode of sepulture, and the narratives of the martyrs and others burnt to death, that large quantities of fuel are needed to convert the body to ashes. It is necessarily *slow* in its progress, and the heat required being high, would extend itself to surrounding substances. The combustion, also, in ordinary cases, would often be incomplete, and particularly so as to the bones. Again, if the body be not wholly consumed, there will be blisters, scars, etc. on various parts.*

* See the elaborate article of Marc on *Spontaneous Combustion*, in the Dictionnaire des Sciences Médicales, vol. vi., translated by Dr. Drake, in his Western Journal, vol. i. p. 130; Julia Fontenelle's Memoir, in Jameson's New Edinburgh Philosophical Journal, vol. v. p. 164; Cyclopaedia of Practical Medicine, art. *Combustion, spontaneous*, by Dr. Apjohn; Edinburgh Medical and Surgical Journal, vol. xxxix. p. 416; American Medical Recorder, vol. v. p. 489, where the alcoholic theory is defended by Dr. Thomas D. Mitchell; and Transylvania Journal, vol. vii. p. 128, where it is opposed by Dr. Caldwell.

A dissection by Dr. Bally is deemed corroborative of the opinion advanced by Marc. He attended a case of typhus, accompanied with general emphysema; and after death, gas was found in large quantities in the cavity of

[M. Tardieu, in the *Annales d'Hygiène*, vol. i. 1854, p. 370, gives the results of some observations and experiments on the ordinary combustibility of the human body which are interesting. In examining the body of several persons taken from the ruins of houses burned in a great fire in Paris, 1852, he found that much of the body remained unconsumed, even under these circumstances. In one body the upper extremities and head were consumed or lost, yet the upper part of the thighs were still adherent, and the abdominal viscera were little changed, only agglutinated together but very easily recognized. The genital organs were recognizable (as to sex) and even some hairs remained on the pubis. He gives the following as the general effects of burning:—

1. Great diminution of bulk.
2. Proportionate loss of weight.
3. Muscles mummified or become parchment like.
4. The blood of the appearance of the fatty matters used for injections and of the bright color of carmine.

Professor St. John assures me that in an examination of two bodies taken from the ruins of a frame house which was burnt to the ground, though the external surface of both was charred

the peritoneum, and even the vessels of the pia mater contained air. This gas, from whatever part it was extricated by puncture, took fire on bringing a candle to it, and burnt with a blue flame. (*Edinburgh Medical and Surgical Journal*, vol. xxxvi. p. 221.)

Devergie, however, denies the applicability of this phenomenon. He insists that it is altogether a *post-mortem* appearance, and may be witnessed daily on the bodies of persons drowned during the summer, which have become emphysematous; vol. ii. p. 295.

The existence of oil in the serum of the blood, first noticed I believe by Professor Traill, and nearly altogether in persons intemperate, has also been supposed to illustrate the combustibility of the system. See Traill, in the *Edinburgh Philosophical Journal*, vol. xiii. p. 375; *Edinburgh Medical and Surgical Journal*, vol. xxiv. p. 421; also Dr. Adam, in *Transactions of the Medical and Physical Society of Calcutta*, vol. i. p. 74. Dr. B. G. Babington (*Medico-Chirurgical Transactions*, vol. xvi.) appears, however, to have detected an oil as constantly existing in healthy blood.

The communication of Sir Henry March, on the *evolution of light from the living human body*, deserves to be read in connection with this subject. (*Med. Examiner*, vol. i. N. S., p. 517.) And also the case of Luminous Breath, by Dr. G. C. Watson. (*Lancet*, January 2, 1845, p. 11.)

and cracked, yet the internal organs were very little altered. Siebold explains this preservation of the internal organs by the fact that the charred and dried surface being a very bad conductor of heat protects the parts below.—C. R. G.]

How strikingly this differs from the phenomena mentioned above, I need scarcely urge. The empyreumatic odor, and the moist and suttly matter resting on the furniture and walls, are wanting, and if Fontenelle be correct, a still more remarkable distinction occurs. In these cases of preternatural combustibility, the hair, the most combustible part in the human frame, is never burnt, while the liver and spleen are always so.

The application of these distinctions in medico-legal cases is manifest, and there are two instances on record which justify the notice that I have taken of the subject.

The first is related by Le Cat, and is that of the wife of the *Sieur Millet*, at Rheims. She got intoxicated every day, and the domestic economy of the house was managed by a handsome young female. This woman was found consumed on the 20th of February, 1725, at the distance of a foot and a half from the hearth in her kitchen. A part of the head only, with a portion of the lower extremities, and a few of the vertebrae, had escaped combustion. A foot and a half of the flooring under the body had been consumed, but a kneading-trough and a tub, which were very near the body, sustained no injury. *M. Chretien*, a surgeon, examined the remains of the body with every juridical formality. *Jean Millet*, the husband, being interrogated by the judges, declared that about eight in the evening of the 19th of February, he had retired to rest with his wife, who, not being able to sleep, had gone into the kitchen, where he thought she was warming herself; that having fallen asleep, he was awakened about two o'clock by an infectious odor; and that, having run to the kitchen, he found the remains of his wife in the state described in the report of the physicians and surgeons. The judges formed an opinion that he had conspired with his servant to destroy the wife, and he was condemned to death. On appeal, however, to a higher court, this decree was reversed, and it was pronounced a case of human combustion; but his health

and fortune were irreparably destroyed, and he died in a hospital.*

The *Gazette Médicale* relates the following facts in a recent number: On the 6th of January last, the body of a man was found lying in bed, and in a state of combustion, by some persons who entered his bedroom in the morning. The chamber was filled with a dense smoke, and one of the witnesses asserted that he saw playing around the body of the deceased a small whitish flame, which receded from him as he approached. The clothes of the deceased and the coverings of the bed were almost entirely consumed, but the wood was only partially burnt. There were no ashes, and only a small quantity of vegetable charcoal; there was, however, a kind of mixed residue, altered by fire, and some pieces of animal charcoal, which had evidently been derived from the articulations. The deceased was in the habit of carrying lucifer matches in his waistcoat pocket, and, according to his usual practice, he had had a hot brick placed at his feet when he went to bed the preceding evening. Two hours after, his son and daughter-in-law passed by the door of his room, but there was nothing which attracted their attention. It was only the following morning early that his grandson found his body in the state described. The deceased was seventy-one years of age. He

* Lair, p. 167. Dupuytren would seem to have been a sturdy disbeliever. He asserts that frequently, when dissecting, he put the debris of the human body in the fire at evening, and they were all consumed in the morning. As to the cases, he imagines, that being all fat, and in a state of insensibility from drunkenness, their clothes take fire, and the carbonic acid thus produced increases the asphyxia; while the skin being burnt, the fat melts and runs out, and thus the process of destruction goes on. Without derogating from his acknowledged talents, I will only add, that Dupuytren was a better surgeon and anatomist than chemist. His remarks are contained in the North American Medical and Surgical Journal, vol. x. p. 181. MM. Bisehoff and Liebig, employed as *experts* in the recent celebrated case of the Countess of Gürlitz, not only declared that *her* case presented an example of *post-mortem* burning, which proved to be true, but took the occasion absolutely to deny the trustworthiness of any of the cases of spontaneous human combustion on record. This position M. Devergie combats, founding his argument upon the consideration of a case which occurred to himself, and of the various accounts of other examples that have been recorded by trustworthy persons.

was not fat, nor was he addicted to drunkenness. The temperature of the air was low, and there were no indications of electricity. The son and his wife were suspected of having murdered the deceased, and burnt his body in order to conceal the traces of the crime; and a Dr. Masson was commissioned to investigate the case. The body, which had been buried, was exhumed and examined. The cravat, partially burnt, was still around the neck, and part of a sleeve of a night-shirt was found. The hands, completely burnt, were only attached to the forearms by some carbonized tendons, which gave way on the slightest touch. The thighs were completely detached, so as to resemble a willful mutilation, but for the discovery of animal charcoal about them. From the facts, Dr. Masson, considering it impossible to ascribe these changes to the effects of accidental burning, and that, under common circumstances, they could only be produced by a violent combustion continuing for some time, drew the inference that the burning must have resulted from some inherent cause in the individual, probably roused into activity by the hot brick placed at the feet of the deceased. The burning once commenced, would be easily supported by the state of the tissues. Hence the case was, in his opinion, to be referred to the class of spontaneous combustion. It is said that Orfila coincided with Masson in this opinion, and that the accused were acquitted.*

E. Of persons found dead from wounds.

The observations already made in the section on medico-legal dissection, and the necessity of considering the subject of wounds on the living body in a distinct chapter, will necessarily contract the remarks that I have to make under this head.

I must again urge the importance of a post-mortem examination in all these cases. An instance mentioned by Foderé will show how culpable any neglect on this point may become. A dead body was found in the fields, in the arrondissement of Trevoux, during the month of May, 1811. The surgeon,

* Atlas, (London Newspaper,) September 25, 1847.

deterred by the putrefactive smell, reported generally that he had discovered no marks of violence. Meanwhile some ditchers, on interring the body, remarked that *on the fall of a handkerchief which covered the head*, the bones of the cranium detached themselves, and the brain issued out. The imperial attorney ordered a special examination of the head, and it was found that the deceased had received three blows with a cutting instrument, which separated the parietal bones from the skull. The assassins, after committing the crime, had replaced these, and secured them with a handkerchief bound very tight; they were afterwards discovered and punished.*

It is important to understand that in legal medicine the term *wound* is used in a much more comprehensive sense than in surgery. In the latter it means, strictly, only a solution of continuity; in the former, injuries of every description that affect either the hard or the soft parts; and accordingly under it are comprehended bruises, contusions, fractures, luxations, etc. In this sense, then, the term wound is to be understood in this work. [It should, however, be remembered that in law no injury is a wound unless the true skin be penetrated. Blows by a hammer or other blunt instrument, though they may cause fractures or other internal (*even fatal*) injuries, do not produce wounds in legal parlance. The continuity of the skin must be broken at the time. Subsequent sloughing will not make the injury a legal wound.—C. R. G.]

The important question to be decided in every case of persons found dead from wounds is, whether the *wounds are the result of suicide, accident, or homicide*.

Besides noticing the surface of the body, and ascertaining whether ecchymosis or suggillation be present, we should pay great attention to the following circumstances: The situation in which the wounded body is found; the position of its members, and the state of its dress; the expression of countenance; the marks of violence, if any be present on the body; the redness or suffusion of the face. The last is important, as it may indicate violence, in order to stop the cries of the individual. The quantity of blood on the ground or on the clothes should

* Foderé, vol. iii. p. 72.

be noticed, and in particular the probable weapon used, the nature of the wound, and its depth and direction. In a case of supposed suicide by means of a knife or pistol, the course of the wound should be examined, whether it be upward or downward, and the length of the arm should be compared with the direction of the injury. Ascertain whether the right or left arm has been used, and as the former is most commonly employed, the direction should correspond with it, and be from right to left.*

When a wound is alleged to have been committed by accident, we may inquire into the probability of this, comparing the stature of the body with the person who caused the accident, and thus ascertain whether the wound could have been received in its existing direction.† The place where the accident has happened, and a comparison of the instrument with the injury inflicted, may also give useful light.

* "By observing this law of nature, murder by another person, instead of *felo de se*, has been detected, as by the discovery of the impression of a bloody left hand upon the *left* arm of the deceased.

"In Patch's case, the evidence went to show that the murder was committed by means of a pistol-shot by a left-handed man. Sergeant Best, in a conference with the prisoner before the trial, pressed him to say whether he was left-handed, but he protested that he was not; yet, on the trial, being called to plead and to hold up his hand, he answered *not guilty*, and held up his left hand." (Dr. A. T. Thompson, London Medical and Surgical Journal, vol. vi. p. 454.)

Again, as to the *direction* of the wound. A few years since, in England, the body of a farmer was found lying on the high-road with the throat cut. The pockets had been rifled. The surgeon who examined the wound found that the knife had been passed in deeply under and below the ear, had been brought out by a semicircular sweep in front; all the great vessels of the neck, with the œsophagus and trachea, having been divided from behind forward. The nature of the wound rendered it improbable that it could have been self-inflicted, and further served to detect the murderer, who was soon after discovered. He proved to be a butcher, and was tried and executed. The cut here had been made as in slaughtering sheep, from behind forward. (Taylor's Med. Jurisprudence, p. 345.)

† Two men of different height fought a duel some years since at Marseilles, with swords, on a public walk. The weapon of each reached the heart of the other at the same moment, and they fell dead together. On examining their bodies, the wound given by the small man was found to be directed from below upward, and that by the larger from above downward. (Foderé, vol. iii. p. 196.)

It must not, however, be concealed, that occasionally cases occur in which, either from the want of exact testimony or from the nature of the injury, the medical witness will be much perplexed in forming a decided opinion. I allude particularly to those instances in which the effects of a fall or other accidental injury may be supposed the results of violence, and *vice versa*, as in the following instance:—

Two persons, one Jacques Charles, the head of a family, and the other a youth, scarcely twenty years old, beardless, and of an inoffensive character, were drinking with others at an inn in France, when the discussion turned on their respective strength. They were merry, but not intoxicated. Jacques repeatedly dared the young man to a contest. When he had done this for the third time, they went out alone, and both returned in a few minutes. Jacques had a severe contusion over the left eye, and there was considerable swelling. He remarked to one of his companions, "I have received quite a thump." No questions were asked as to the manner in which it had happened. The party separated soon after. Jacques returned home, went to bed without making any complaint, but the next morning told his wife that he had received his death blow. She asked him how, and he replied, "in falling."

Dr. Melet was sent for that morning. Jacques was delirious, and could not speak. Leeches were applied to the injured part, but he grew worse, and died on the 22d. The injury was received on the evening of the 18th. Dr. Melet, when called, observed no lesion except the swelling on the lower part of the frontal bone. The epidermis was not injured. The wound did not appear to have been made by a smooth or a rough stone. In either case he supposed there would have been a solution of continuity of the skin. Nor could it be from a fall, since then the top or the base of the head would first be struck, and thus the lower part of the frontal bone would have been protected from injury. Dr. Melet, however, considered it equally improbable that so severe an injury could be caused by a blow of the fist.

On dissection, the left eyelid and a part of the front of the left cheek were observed to be much swollen, and of a black color. A fracture was traced from the left eyebrow across

the left eye. The inflammation here induced had extended to the brain, and thus caused death. The examiner, Dr. Tueffert, found no other mark of contusion. When asked whether a blow with the fist could have caused this fracture, he replied that it must have been a very powerful one. It was possible that it might have occurred from the deceased falling with great force with his head foremost.

The characters of both the individuals concerned were proved to be good, and not quarrelsome. The prisoner, when arrested, stated that the accident happened in this wise. Jacques, on leaving the door, jumped at him from behind. He knelt down to avoid him, and Jacques fell head first on a stone, and the prisoner fell at the same time on him.

After hearing counsel and the charge of the judge, the jury brought in a verdict of acquittal.*

At the Perth circuit court, Scotland, in April, 1836, Mary Finlay was charged with murdering her husband, by striking him with a poker on the legs, dashing the house door violently against his person, and beating him to the ground, whereby his legs were broken, and he died in consequence about a fortnight afterwards.

It appears that the deceased was intemperate. He was struck, while lying on the floor, twice across the shin with a heavy poker. A witness after this assisted him in undressing, and saw blood on his leg. But he refused to go to bed, and limped toward the door, when she heard him cry out that his legs were caught between the leaves of it. He was shortly after dragged in by the witness and the prisoner, and she now observed the bone to protrude.

A surgeon proved that he died of the injury and subsequent delirium tremens. There was but a slight swelling about the wound, and no ecchymosis on any part of the limb. On disinterment, both bones of the legs were found broken.

Professor Syme, on examination, stated his opinion to be, that a fall could not have caused this fracture, but that a blow might. It was possible that there had been a fracture first

* Gazette des Tribunaux, August 5, 1845.

without displacement, and the crush at the door might have caused the remaining injury.

Prof. Lizars, on the other hand, considered the injury to be the consequence of a fall. If from a blow, he should have expected bruises or ecchymosis to be present. He also thought that the fibula might have been broken after disinterment, and considered it impossible that the deceased could have walked fifteen feet with a broken tibia.

Amid this discordant medical testimony, the jury judiciously grounded their verdict on the conceded blows with the poker, and being found guilty of this only, the prisoner was sentenced to twelve months' imprisonment.

Professor Syme, in his comments on the above testimony, objects to the opinion that the fibula was subsequently fractured. If so, we must believe that the broken end of the tibia could project three or four inches through the wound, while the fibula remained sound. He also quotes a case where the wheel of a carriage passed over a female's leg, and produced a compound fracture of the tibia. Yet there was no ecchymosis in the neighborhood of the wound immediately after the injury, or at any time subsequent. But the skin over the knee and lower part of the thigh was discolored, and in the course of a few days sloughed.*

In another case, the occipital and temporal bones were found broken; the lambdoidal suture separated to such a distance as to allow the handle of the scalpel to be passed into the opening, and the petrous portion of the temporal bone scattered, and splinters of it driven into the substance of the brain. The question in the absence of positive testimony, was, whether the subject, a female, had received these fatal wounds from a fall

* London Medical Gazette, vol. xviii. pp. 180, 187; Edinburgh Medical and Surgical Journal, vol. xvi. p. 254. As to the objection that persons with a fractured tibia could not walk a few steps, Professor Syme asserts that in several subsequent cases of compound fracture, the patient actually did walk, and this power even remained in an instance of fracture of the thigh-bone.

Dr. Norris, of Philadelphia, also adduces several instances from Sabatier, Desault, Boyer, and others, and some from his own observation, in all of which patients were able to walk with the aid of a stick, after a fracture of the neck of the thigh-bone. (American Journal Med. Sciences, vol. xxv. p. 282.)

backward down a flight of stairs on a stone pavement, or whether they were produced by a blow of a hammer, or some similar instrument used by the husband in his occupations? The possibility of either seems to have been allowed.*

It has at various times been a subject of anxious discussion, whether there are any proofs to be drawn from the nature of the wound, discriminative of the injured individual falling on the weapon, or of it having been thrust into him. This question was put to the medical faculty of Giessen under the following circumstances: On the 29th of November, 1685, at night, J. Scheffer, of Arheilgen, was found dead in the City of Giessen. The examiners discovered a wound in the right side, two fingers' breadth below the nipple, and between the second and third ribs. It penetrated through the muscles, the superior lobe of the right lung, the pericardium, and the vena cava, to the left lung.

The accused said that the deceased had rushed on his sword. The companions of the latter were throwing stones, and with his drawn sword he ran forward to the prisoner, who, falling, met his fatal wound. The fiscal, on the other hand, denied the possibility of this. The deceased was not thrust through the body, but the wound was inflicted on the right side, a position in which he could not have been placed unless he had run sideways.

The medical faculty of Giessen, on being consulted, answered in favor of the prisoner for the following reasons:

* British Annals of Medicine, vol. i. p. 185. There is another curious case related in the London Med. Gazette, vol. xxiii. p. 517, by Mr. Hullam. Two boys had been playing and romping, when one fell with his knees on the other. The deceased, fourteen years of age, did not complain of being hurt, attended to his usual work in the factory until four days after, when he experienced great pain in the hip and lower part of the abdomen, and it was found necessary to carry him home. He was carefully treated, but died in five days thereafter. On dissection, the left os innominatum was ascertained to be extensively fractured, and large quantities of purulent matter were present. The cartilages of the joint were diseased, but the ligaments were entire.

Mr. Hullam and Mr. Arth gave it as their opinion that the boy could not have gone on with his employment, *which was not sedentary*, for the four first days, with the above injury existing. There was, however, no evidence that it could have occurred in any other way, or at a later period.

The deceased was drunk and in a great rage, and the motion which the French called the *passade*, might have inflicted the wound while he was rushing with great fury on his antagonist.*

Foderé quotes another case from Kopp, illustrative of this question: "A miller was assassinated at his own door by a butcher, who pretended that he had no intention of killing him, but had only threatened him with his knife, in consequence of some maltreatment which he had received; that the miller renewed the attack, and in attempting to pursue him, made a false step, and had fallen on the weapon. A single external wound which led downward to two wounds of the left ventricle of the heart, separated from each other by an interval of two lines, showed that the accused had employed the same method to destroy his victim as that used by the butchers in Germany to kill cattle; that is, after having driven the knife into the heart, they withdraw it some distance and replunge it, so as to make a second internal wound. Thus the direction of the wound, compared with the respective statures of the two adversaries, (the butcher being much smaller than the miller), proved that the blow had been inflicted obliquely from above downward, viz., while the miller was sitting at his door, and not by a fall after getting on his feet, in which case the wound must have taken an opposite direction."†

Stephen Videto was, in July, 1825, tried at the court of oyer and terminer for Franklin County, (N. Y.) for the murder of Mrs. Fanny Mosely.

It appeared that Mrs. Mosely had been married to a worthless individual in Canada. Shortly after her union, he brought

* Valentini's Pandects, vol. i. p. 240. In the London Medical and Physical Journal, vol. xxxi. p. 467, an anonymous correspondent remarks that in the account of the late trial of Major Gordon for the murder of a private soldier, by holding in his hand a sword on which the deceased fell, it is stated that Messrs. Snowden and Blake gave medical evidence, and they deposed that from the appearance of the wound, they would take it upon themselves to declare that it must have been inflicted by the body falling upon the sword, and not occasioned by a thrust of the weapon. The writer solicits information as to the mode of discriminating between these.

† Foderé, vol. iii. p. 196. I am indebted to Dr. Beatty for this reference, which escaped me in the previous edition.

her from her parents, under pretence of visiting his, to a tavern at the town of French Mills, and there deserted her, taking with him all her property. In this destitute situation, she applied herself with assiduity to the tailoring business, and finally accumulated some hundred dollars, with which she purchased a small farm.

In March, 1824, she went to reside at the house of the prisoner's father. The family then consisted of his father and mother, a brother and sister, the prisoner and the deceased. The house consisted of two ground rooms, one called the kitchen, in which the old people slept, and the bedroom at the west side of the house. In this last there was one window at the west side, and another at the north end, a little east of the centre. At the northeast corner of the room stood the bed of the prisoner, with whom the brother slept, and at the northwest corner, that of the deceased, with whom the sister was a bedfellow. The heads of both beds were to the north, and there was a space of about one yard between them, in which a screen or curtain was usually hung. It was also shown that the bed of the deceased was more than one foot lower than the bottom of the window.

In January, 1825, the prisoner asserted that he had seen armed Indians about the house in the night-time, and he supposed that they harbored hostile designs against him. Under this pretence, (for no other persons had seen them), he borrowed a pistol and two guns and provided himself with ammunition.

On the 1st of February, the brother and sister were both absent from home, and of course the prisoner and deceased were left alone. The prisoner asserted that he was watching during the night, from the apprehension of an attack, and sat up in bed with his gun lying across his lap. While thus employed, a gun was suddenly thrust through the north window and discharged at Mrs. Mosely, who was then asleep. He immediately fired his gun out of the same window, but saw no one.

Such was his account. It was found, on examination, that the ball entered the back of the deceased near the spine, a little above the left hip, and passed out near the left breast

nearer to the head than it entered. She died of the wound in two hours. The window, consisting of fifteen lights, had six broken in the lower sash. *The broken sash and almost all the fragments of glass were on the outside of the house.* The ball was found in the covering over the deceased. Mrs. Mosely mentioned before her death, that she lay in bed with her head to the north, her face to the west, and her body bent forward considerably.

On dissection, the lowest rib was found cut square off, at an inch or an inch and a half from the spine. There was, therefore, no glancing. The lower lobe of the left lung and the heart were perforated with a ball and shot.

The examining physicians placed the body in the position above described, on the bed, and then placed persons on the outside of the house, to ascertain whether a ball from a gun would reach her as stated by the prisoner. It was found that she must have lain in a most unnatural posture in order to be reached, namely, that of a person vomiting. Her account was very different.

It also appeared on the trial that the prisoner had purchased arsenic, and probably given it to the deceased, whose health had for some time previous been in a declining state.

Videto was found guilty and executed, asserting, however, his innocence to the last.

The solution of this case remains to be given. It is the usual sequence of seduction and murder. On the dissection of the body, the murdered female was found to be pregnant. This fact was known to the district attorney, but from a regard to the feelings of the relatives of the murdered person, it was not brought in testimony. Videto confessed that he was the seducer, to Judge (now Chancellor) Walworth, before whom he was tried, a few days after his conviction.*

Not only the course of the wound is thus to be noticed, but some attention should be paid to the known comparative strength of the parties. In a recent case in England, a feeble old man aged upwards of seventy years, was accused, on the

* For a perusal of this trial and the additional facts mentioned, I am indebted to the kindness of Chancellor Walworth.

testimony of a very suspicious witness, of having killed an individual aged twenty-four, by two or three blows on the head with a common stick. On dissection, the skull was found *broken into thirty-five pieces*. I do not know the result of the accusation; but several experiments were performed on the dead body, distinctly proving that, even with a loaded stick, such extensive injury could not be effected after nine or ten blows.*

We must also recollect that cases like the following may occur:—

In 1808, during a quarrel among some drovers at an inn in France, one was wounded with a knife on the face, hand, and upper part of the thorax near the right clavicle. When the riot ended, the injuries were examined, and found to be superficial and slight. They were washed, and an hour afterwards the wounded individual departed for his home. He was, however, found dead the next morning, bathed in blood. Dissection was made, and the left lung and pulmonary artery were found cut. The surgeons deposed that this was the cause of death, and that it must have been inflicted after the superficial wound on the thorax, which was not bloody, but surrounded by ecchymosis. Such proved to be the fact; on his way home he had been robbed and murdered.†

Again, an intoxicated individual was severely beaten, but was able to walk a mile and a half, to call on his physician, Dr. Davat. He did not speak, but continued in one position, allowed his comrades to tell the circumstances, and when they left followed them without staggering or receiving any assistance. This was at six in the evening, after which he continued with them until nine, when he fell and became comatose, and continued so, in spite of medical assistance, until one o'clock P.M., the time of his death.

The body was examined in forty-eight hours after. There was no ecchymosis, scratch, or contusion on the surface of the body. Although, however, the scalp appeared perfectly natural, yet on cutting into it, the cellular tissue was seen infiltrated

* Midland Medical and Surgical Reporter, vol. ii. p. 358.

† Chaussier, Recueil, p. 139.

with black blood, and two large fractures of the parietal bone were discovered; blood was also collected between it and the dura mater. The viscera were healthy, but there was a longitudinal laceration of the diaphragm, two inches and a half in extent; and the herniated portion of the stomach was also ruptured and had discharged its contents into the thorax. Small clots of blood accompanied the effused aliments.

The question immediately arose, whether the deceased had sustained these lesions when he was seen by Dr. Davat in the evening, one hour after the injury. As to the fractures of the skull, there could be no doubt but that they were the consequence of blows; but could the diaphragm be thus ruptured and the patient survive nineteen hours? Was it not rather owing to a fall without violence; or, as Dr. Davat supposes, occurring either immediately previous to death, or possibly directly after it? At all events, so far as experience extends, we may doubt whether such ruptures of the diaphragm and stomach are compatible with life beyond a brief period.

On the trial, the accused had the benefit of these doubts, and although found guilty, was only sentenced to seven years imprisonment.*

When a person is found dead at the foot of a precipice, or appears to have fallen from any height, we should naturally expect that fractures, irregular wounds and contusions, would be present. But along with these, we may happen to find incised wounds, regular in their form. If not made after death, (and we have already explained the appearances by which this may be ascertained,) they are either the work of the individual himself, previous to his fall, or of assassins.†

* Edinburgh Medical and Surgical Journal, vol. xliii. p. 499, from the *Archives Générales*. Medico-Chirurgical Review, vol. xxvi. p. 522.

† Although I shall advert more at large to the subject in the chapter of "Wounds on the Living Body," I cannot too early suggest the hazard to their reputation that medical witnesses assume in *positively* stating the description of weapon that has been employed to cause injury or death. The nature of wounds, their form and condition, are scarcely yet sufficiently settled to warrant us in asserting that *this* is caused by a blunt instrument, and *that* by a sharp-pointed one. Take the following example:—

In the case of Thom, convicted of murder in 1843, in the State of Maine,

In 1819, at Castellane, in France, a laborer conducting an ass loaded with wheat, was found dead at the foot of a high precipice aside the main road. The ass also had fallen, but was still living. The wheat was scattered along the face of the rocks. The body exhibited a number of irregular wounds and contusions; the under jaw and clavicle were fractured, and one of the subclavian arteries was wounded.

The prevailing opinion was, that the ass had stumbled over the rocks, and the conductor, in attempting to recover it, had fallen, and thus lost his life. But presently a bonnet, *not* belonging to the deceased, was discovered, and it was then recollected that a neighbor of furious temper had been on bad terms with him. This led to a more minute examination. On the back and side of the head, three or four incised wounds were observed, perfectly regular in their shape, without any marks of contusion between them, or any jagging of their edges. Other wounds of this description were found on the chest, but the arms and hands were uninjured, there being only a slight excoriation on one finger.

The inference was irresistible that the deceased had been murdered previous to falling down the rocks. These could hardly have caused *several* wounds so regular in their shape, and so closely resembling each other. And again, a man struggling for life would certainly, in this situation, have con-

there were two wounds on the head of the deceased—one lacerating the ear, the other under and a little forward of the ear and accompanied with a fracture of the skull; the temporal artery was ruptured, and the scalp, with a part of the temporal artery and the fractured bone, was driven upon the brain. The surgeon who made the examination of the body found the bow of a large pair of wrought-iron tongs belonging to the house, corresponded to the form and size of the wound, and was of opinion that the wound was inflicted by that, or some such instrument; while two other surgeons agreed that it was caused by some blunt instrument—a brickbat or something similar.

The criminal, after conviction, confessed that the blow was inflicted with an *axe*. (Law Reporter, vol. vi. pp. 52, 94.)

[When Physician to the City Prison, I had frequent opportunities of satisfying myself that a blow upon the head with the club of a policeman, a round smooth stick, would cause a cut of the scalp so clean that nothing but the more certain proof would satisfy any one, that the injury was not caused by a sharp instrument.—C. R. G.]

tused and wounded his arms and hands. The murderer, for so he proved, was condemned and executed.*

Madmen and suicides, it must be remembered, often inflict the most painful and extraordinary wounds on themselves. In suspected cases, we should ascertain the previous history of the deceased, his state of mind, and worldly situation. The countenance should also be noticed. In suicides, it is usually haggard, the eyes are sunk, and this physiognomy continues while a spark of vitality remains in the body. Those, on the contrary, who are the victims of assassination, have a degree of paleness and fear imprinted on their visage.†

These directions, though they may appear minute, are very important, from the difficulty of the subject, and the fact that there is scarcely any description of wound which may not be inflicted by an individual on himself. Some, however, may be excepted, as when a person has been wounded by a small and sharp-pointed instrument in the spinal marrow, and generally, indeed, all wounds from behind.

Fire-arms are frequently used as an instrument of death, and here some inference may be drawn from the nature of the wound. If the ball has passed through the body, it is probable that the murderer was near, or that the individual inflicted it on himself. We cannot, however, rest much on this fact, since a great deal will depend on the strength of the charge and the resistance offered by the parts of the body. The direction is of more importance. "It may be taken for granted," says Dr. Smith, "that if the weapon has been introduced into the deceased's mouth, and there discharged, it has not been done by another."‡ Conceding the great probability of this, it must also be recollected that a suicide *may* inflict a wound on him-

* Poilroux, Méd. Legale Criminelle, p. 97.

† Foderé, vol. iii. pp. 181 to 188.

‡ A case of this nature is related by Devergie, which deserves notice for its circumstances. The pistol was introduced into the mouth and discharged. The ball lodged in the brain, and no mark of external injury could be discovered on the dead body. The hands were perfectly clean, the lips untouched by the powder, and the countenance calm, nor was it until the jaws were forced open, that the extensive destruction of parts was discovered. (Devergie, vol. i. p. 306.)

self from behind. A man at Paris, after some years of insanity shut himself in his chamber, from which was shortly heard the discharge of a pistol. On entering the room he was found barely alive, with a wound behind the right mastoid apophysis, and the occipital bone fractured and broken. He survived two hours, and on dissection, the ball was found lodged in the cerebellum. It was evident that the pistol had been fired with the right hand placed behind the head, and probably the head was inclined to the left.*

An examination of the entrance and exit wound is also important in enabling us to determine the direction. "That made on entering is smaller, and has its edges inverted and depressed, while the latter is much larger, with ragged, everted, and uneven edges—a circumstance depending upon the direction in which the force is applied to the skin, as well as upon the diminished velocity of the ball. When a musket-ball passes fairly through the cavity of the chest, the orifice of entrance is round, depressed, dark-colored, and more or less bloody in the first instance; the orifice of exit is generally more of a ragged slit or tear than a hole. (Guthrie, in *Lancet*, April 2, 1853.)†

When flat bones are perforated by balls, the same difference in the size and appearance of the two openings is to be observed. A trial, in which the defence rested upon the difference between the wounds, took place a few years ago, in Kent, and is recorded by Dr. Gordon Smith. An officer in the preventive service was indicted for the murder of a man who was shot in the night, under circumstances of a suspicious nature as to his pursuit at the time. There was no doubt that he was in company with a party of smugglers, and came by his death accidentally. He was retreating before the prisoner, who tripped, and in the fall his gun went off. It seems that, on the other

* Case by Dr. Dance; Orfila's *Leçons*, second edition, vol. ii. p. 543.

† Dupuytren fired through several boards placed at the distance of two or three inches from each other. The exit hole in the first board was much larger than the entrance one; the entrance hole in the second board larger than the corresponding one in the first, and so in an increasing ratio. Hence if two men are wounded by the same ball, unless its velocity be greatly diminished, the wound of the one last struck, will be the largest. (Devergie, vol. ii. p. 79.)

hand, several shots were fired by the smugglers on their retreat, and that the deceased was killed by one of them. This appeared from the testimony of a navy surgeon, who examined the body. He found the wound in the upper part of the groin much smaller than that in the lower part of the buttock, which was twice or three times the size of the former, and was ragged and uneven. Fragments of the bone were likewise felt at the hinder opening, but none in the cavity of the pelvis. From these appearances, he gave his opinion that the ball had entered in front, and had come from his own party.*

In a French medical journal, there is stated the following case as occurring a few years since:—

An old man was fired at from a deep ditch on the roadside, during a thick fog, and killed on the spot. A near relative, who was successor to his property, and whose menaces and conduct for some time previous were of an alarming nature, was suspected of the murder and arrested. It was proved that a few minutes before the murder was committed, he was seen very near the fatal spot with a fowling-piece in his hand. On inspection by the surgeons, it was found that death had been occasioned by two balls, one of which cut the aorta across, and the other passed through the ileum. The hole in the ileum was perfectly circular, and when accurately measured, was found to be eight lines in diameter. The calibre of the prisoner's fowling piece (the only arms in his possession,) was

* *Cyclopaedia of Practical Medicine*, art. *Persons dead from wounds*, by Dr. Beatty, vol. iv. p. 561.

Another instance is given in the English State Trials. Richard Annesley was tried for the murder of Thomas Eglestone, a poacher. The prisoner was in company with the game-keeper, and he asserted that his gun had gone off accidentally in attempting to secure the deceased. It appears from the evidence of the surgeon, that the direction of the wound was upwards, and consequently the fowling-piece had not been leveled from the shoulder. The jury brought in a verdict of chance medley. (Paris, vol. ii. p. 126.)

In a duel fought at Paris in 1827 with pistols, the person killed was much taller than his antagonist, yet the mortal wound was obliquely downward. Suspicion was excited, and an investigation made by Breschet, Denis, and Precsat. The ball was found to have struck the clavicle obliquely, and in consequence of its resistance, to have thus deviated. They added in their report, that they had witnessed many analogous cases. (Briand, second edition, p. 298.)

found to be only six and a half lines in diameter. This circumstance at once set the prisoner at liberty.

Some time after this, however, an old officer committed suicide by means of a cavalry pistol. The ball perforated the parietal bone, traversed the brain, etc. The hole where it entered was perfectly circular, and when accurately measured, was found not only greatly to exceed the calibre of the pistol but in fact to admit, without much force, the barrel of the pistol itself.*

Baron Dupuytren, on this subject, observes that when the gun has been discharged close to the wounded part, the opening by which the ball enters is smaller than that by which it makes its exit, but if at a distance, so that the ball is nearly spent, then the reverse will be observed. The canal made in the former case will be conical. The hole made by a ball in clothes, is always smaller than that in the skin.† It is hardly necessary to remind the young surgeon that balls frequently take remarkably circuitous routes.‡

In a still later memoir, Ollivier throws some doubt on the universality of the rule, as to the comparative size of the entrance and exit wounds. He asserts that in many instances he has seen the former the largest, and mentions one of a person shot in the groin at thirty paces. This wound was larger than the exit one in the buttock. Whether the resistance in passing through the pelvis might not place this case under the rule

* *Medico-Chirurgical Review*, vol. v. p. 504, from the *Gazette de Santé* of January, 1824.

† *London Medical Quarterly Review*, vol. iii. p. 133; *Medico-Chirurgical Review*, vol. xxv. p. 291.

When the fire-arm has been discharged very near to the person injured, the wound often resembles a burn in many respects. It has a red or dark appearance, coagulated blood mixed with powder or powder-dust, is observed on the edges, and the skin around it is filled with particles of unexploded powder. (*Devergie*, vol. ii. pp. 88, 93.)

‡ The most singular instance is that mentioned by Dr. Hennen; the ball struck the breast and lodged in the scrotum, the man standing erect in the ranks. Sometimes the tortuous course of the ball may be traced by a dusky line, but even this is not always present. The inference is obvious in cases of wounds, not to pronounce an injury fatal until we are sure that the ball has penetrated. (*Dr. A. T. Thomson*, *London Med. and Surgical Journal*, vol. vii. p. 325.)

of Dupuytren, and thus assimilate the projectile to a spent ball, I will not pretend to decide. But however this may be, the earnest advice of our author to examine the injuries to the dress and clothing, cannot be too much insisted upon. Frequently this alone may serve to settle a disputed case. And we should recollect that there is always more or less a loss of a portion of the clothing at the part corresponding to the entrance wound.*

The following observations of the late Professor Staughton will also throw considerable light on this subject. After stating that Dr. Hennen is the first who noticed that balls will course along *concave* as well as *convex* surfaces, as, for instance, between the pleura costalis and the lungs, he proceeds to point out the striking difference between the effects of a *musket* and a *rifle* ball. "The motion of a musket ball, independently of its projectile course on its own axis, is at right angles with its direction. Hence when a musket ball strikes the flesh, the hole made is smaller, to all appearance, than the ball itself. The barrel of the American rifle, on the other hand, is grooved, not in a longitudinal direction, as the French and German rifles, but in a spiral manner. The ball is forced down so tightly, that as it passes out it is under the necessity of following the course of the spiral groove. This imparts to it a motion on its own axis, corresponding with the direction of its course. Besides, the whole ball follows a spiral direction, forming in its progress a hollow cylinder, if I may be permitted the expression. Hence the *ragged hole*, which our hunters know so well, is always much larger than the ball. Hence the rifle ball, at full momentum, does not, like the musket ball, remove a cylinder of muscle and bone, but by its rotary motion tears the flesh and shatters the bone. Hence, too, unless the ball is nearly spent, it never glances."†

* Annales d'Hygiène, vol. xxii. p. 319. Malle, Professor at the Military Hospital of Strasburg, coincides in opinion with Ollivier, both from his observations on the living, and his experiments on dead bodies. In all and each, the entrance hole was larger than the exit one. The latter was only less regular than the former, and its edges were prominent, and thus distinguished from the rounded and depressed appearance of the former. (Ibid., vol. xxiii. p. 458.)

† Western Journal of Medical and Physical Science, vol. iv. p. 380.

Collateral circumstances will also throw some light on cases of this nature. Two have lately happened, the one in England, and the other in France, where the wadding was examined, and discovered to have been torn from paper found in the possession of the murderer.* Again, a man was found shot, and his own pistol lay near him, from which circumstance (and no person having been seen to enter or leave the house of the deceased) it was concluded that he had destroyed himself; but on examining the ball by which he had been killed, it was found too large ever to have entered that pistol; in consequence of which discovery, suspicion fell upon the real murderers. Authors have also mentioned the discoloration of the fingers from the combustion of the powder in the pan, as a mark of suicide, but a crafty assassin might also have recourse to it.†

Again, it is a common remark, says Orfila, that the presence of two or more mortal wounds in various parts of the body, is a decisive proof of homicide, on the presumption that an individual having already inflicted one on himself, has not the strength to produce the second. Although correct as a general

* Gordon Smith, p. 281. Lord Eldon, late in life, told this striking story of an assize scene to one of his daughters: "I have heard some very extraordinary cases of murder tried; I remember in one where I was counsel, for a long time the evidence did not appear to touch the prisoner at all, and he looked about him with the most perfect unconcern, seeming to think himself quite safe. At last the surgeon was called, who stated that the deceased had been killed by a shot, a gun-shot in the head, and he produced the matted hair and stuff cut from and taken out of the wound. It was all hardened with blood. A basin of warm water was brought into court, and as the blood was gradually softened, a piece of printed paper appeared—the wadding of the gun—which proved to be half of a ballad. The other half had been found in the man's pocket when he was taken. He was hanged." (Twiss' Life of Lord Eldon.)

† Such of my chemical readers as are curious on the subject, I will refer to the *Annales d'Hygiène*, vol. xi. p. 458, where an account is given of M. Boutigny's experiments to determine the period which may have elapsed after the discharge of a piece of fire-arms. There is a translation of the same by Mr. Fisher, from the *Journal de Chimie Médicale*, in the *Philadelphia Journal of Pharmacy*, vol. vi. p. 207. See also, *Baltimore Medical and Surgical Journal*, vol. i. p. 501.

Subsequently, M. Boutigny has pursued the subject by an inquiry into the proofs of the fire-arm having been cleansed or washed, after being discharged. (*Annales*, vol. xxi. p. 197; vol. xxii. p. 367.)

rule, it must be taken with exceptions, and particularly so if the first wound be not of a nature to produce instant death. A determined suicide may, in the few moments of his existence, repeat the blows on himself. The following instance is given by our author, on the authority of Dr. Vingtrinier, of Rouen: Mr. G. was found dead in his chamber, with two pistols, one near his body, and the other on the bed, at the distance of six paces. An inquest proved that the first pistol was fired when he was on the bed; that it had broken two ribs, and wounded the lung. In spite of this severe injury, Mr. G. had gone into a neighboring room, obtained the other pistol, and discharged it through his head. This produced instant death.*

In connection with the subject of fire-arms, we must also recollect that death may result from their discharge when loaded with *shot*, and the appearances presented are in some respects different from fire-arms loaded with *ball*. A recent communication by Professor Lachese, of Ager, has materially added to our knowledge on this point.

In one case where an individual was instantly killed at the distance of six inches by a gun which was supposed not to be loaded, there was found an oval wound ten lines by thirteen in the right side of the neck, but on examining it internally, it was ascertained to be much larger, and filled with splinters of bone and fragments of the tissues. There was another small wound just below the scapula. On dissection, the subclavian artery and vein, the carotid and internal jugular, the lower part of the larynx and the upper part of the trachea, with portions of some of the vertebræ and the ribs, were all seen to be injured, and some grains of shot had traversed the upper portion of the lung. The shot and wadding were found in the back part of the neck, within a space of about five inches in diameter.

* Orfila's *Leçons*, first edition, vol. i. p. 717. Our author quotes a still more striking case in his third edition, vol. ii. p. 665, on the authority of Ollivier d'Angers: A young man discharged a pistol into his mouth. It fractured the roof, tore the tongue and velum, and dropped from the œsophagus into the stomach. He then endeavored to fracture his skull with the butt-end of the pistol, and inflicted no less than thirty wounds on the front part of his head, most of which penetrated to the bone. Finally, he hung himself on a neighboring tree. See also, case of the Silesian butcher, *ante*, p. 69.

The extensive injury produced in this, and a similar judicial case, induced Prof. Lachese to perform a number of experiments with guns loaded either with shot or with powder only. Notwithstanding the difference which may depend on the kind of fire-arms, the quantity and quality of the powder, he thinks that the following conclusions may be depended on:—

1. A gun loaded with shot, fired so near as to make but one hole, does not produce the same injury as a ball; the wound is more serious and more extensive.

2. In order that a discharge of powder shall penetrate into the cavities, and make an external wound like that produced by shot, making but one hole, the gun must be of great calibre, be heavily charged, and there must be less than six inches between its muzzle and the body wounded.

3. To produce with a gun loaded with shot, a single round aperture, the gun must be fired at ten or twelve inches distance at the most. At from one foot to eighteen inches, the aperture will have its edges torn by a greater or less number of shot, and some of them will pass inwardly; while at three feet there will be no central wound, and from that to still greater distances the shot will scatter over a larger space, in proportion to the distance, the goodness of the fire-arm, and the smallness of the charge.

4. If, instead of being discharged on the naked body, as until now we have supposed, the body is covered with clothing, the same effects may take place, but not at the same distances. In proportion to the thickness and consistency of the dress the distance must be diminished.*

* *Annales d'Hygiène*, vol. xv. p. 389. *Dunglison's American Med. Intelligence*, vol. i. p. 111. In the chapter on *Wounds on the living body*, some additional remarks on injuries by fire-arms will be found. I will here only add a case related by Dr. Graff, of a young man aged fifteen, who received a discharge of small shot in the thorax and abdomen, at the distance of about forty-eight paces. He fell, but soon afterwards got up and ran for about six hundred paces, when he again fell exhausted. Several wounds were discovered, from one of which, between the first and second ribs, florid blood issued. He died in thirty-eight hours. On dissection, the sixth intercostal artery was found torn through, a large quantity of extravasated blood was seen, and an opening was traced from the external wound into the substance of the right lung, but no foreign body could be discovered, nor was there any

The narrative of a few cases will form a proper commentary on the above remarks. I commence with one that was undoubtedly accidental.

On the 8th of February, 1792, S. D., aged about thirty years, and of a robust constitution, became intoxicated at an inn near Morges, in Switzerland, and in a room heated very warm by a German stove. At eleven o'clock at night he left this place quite drunk, in order to return home, a distance of half a league. The weather was cold, and the ground covered with snow. The next morning this man was found dead at the side of a ditch, at a small distance from his dwelling. A report soon circulated that he had been assassinated, and a medical man, who saw the body, asserted it. The supposed murderer was already pointed out, when Dr. Desgranges, who then resided at Morges, was ordered to inspect the body.

No traces of injury were found, nor indeed any contusions, until in turning the head from the left to the right side, an oblique wound, about three-quarters of an inch externally, was discovered, situated below the under jaw, and nearly at the top of the larynx. On introducing the little finger into this aperture, its size, internally, was found greater than its external appearance indicated. Its depth was about one inch, and extended to the œsophagus and top of the trachea. The clothes of the deceased were stained with blood, as was also the snow on which he lay.

As the wound which presented itself did not resemble any inflicted by ordinary instruments, Dr. Desgranges was of opinion

communication by which it could have passed out. The case was referred to the Medical College of the Grand Duchy of Hesse, who showed conclusively, from the previous good health of the deceased and the absence of all morbid changes, that there could have been no aneurismal enlargement or abscess of the intercostal artery; that the shot had passed from above downward, and its absence was no proof that it had not inflicted the wound, as the deflection of projectiles is well understood. Each of these objections had been urged. The points in this case particularly deserving of notice are the smallness of the external wound; the difficulty of connecting it in consequence of the collapse of parts with the deep-seated injury; the absence of the missile; lastly, the fact that a wound of the intercostal artery near the aorta may prove fatal. (British and Foreign Med. Review, vol. iii. p. 536, from Henke's Zeitschrift.)

that it was caused by a kind of auger which the deceased had taken with him from the tavern, and which he had held under his arm, with the handle backward. This was found lying at the side of the man, covered with clotted blood. The truth of the conjecture was confirmed by opening the wound and putting the auger into it, when it was found to apply completely. On further dissection, it was ascertained that the left carotid had been wounded, and that hence the immediate cause of death had been the hemorrhage from it. These facts proved the injury accidental; it was supposed, that in endeavoring to remove the auger on which he had fallen, he had moved it round, and thus made the internal wound larger than the external.*

[*Case of Sellis.* As this case caused very great excitement at the time of its occurrence, and is generally merely alluded to in the books, I have thought that an abstract, prepared from the testimony before the coroner, would be interesting.

On the 31st of May, about half-past two in the morning, the Duke of Cumberland was, as he alleged, waked by something striking his face and head twice, which he thought was a bat; a third blow convinced him that some one was attacking him; he sprang from his bed, and after receiving several other blows, was struck across the legs just as he was escaping into an adjoining closet. He called with a loud voice, and his English valet came to his assistance. The room was only lighted by a night-lamp on the hearth, the light of which, as it gleamed upon the weapon, the duke said was like lightning flashes. The valet testified that he found the duke bleeding from several wounds, which, however, did not prevent his moving about, and going from room to room, though after a time he complained of being faint. On his person were found six wounds, all in front, and neither at all severe. One was on the forehead, near the top of the head, one down the cheek, one on the arm, one in front of the body, one on the thigh, and one nearly cutting off the little finger. Besides these, there were several punctures. The room was in disorder, the picture-frames

* Foderé, vol. iii. p. 190. Renard remarks (p. 109) that the lungs of those who die from wounds are seldom found gorged.

hacked, etc. On the floor was the large military sabre of the duke, the edge nicked, and the blade covered with blood. Sellis, the duke's Italian valet, was now sought for, and found in his bed quite dead, his throat cut, the wound six inches long, dividing the arteries on both sides, and, according to some accounts, nearly severed the head from the body. About two yards to the left of the body a bloody razor was found. His neck-handkerchief was cut in several places, and blood was spattered upon the wall, the curtains, the wash-stand, basin, and drawers; in the basin was considerable bloody water.

The body lay extended, the arms beside the trunk; no appearance of struggle. On this state of facts the theory of the jury was, that Sellis had attacked the duke, while asleep, with the large military sabre; that not succeeding in his attempted murder, he went to his own room and cut his throat. To this theory there are certainly some very strong objections. A man attacks another, while the latter is in bed asleep, with a large military sabre, and yet the blows are so light as to resemble the flutter of a bat's wing. Two wounds are inflicted on the head, yet there is no injury of the bone, no concussion; the wounds are mere scalp cuts. There is one wound on the trunk in front; no rib is broken, no cavity penetrated; it is merely *skin-deep*. The arm is raised to protect the head, and receives a fourth wound. Again is there no bone broken, only another *skin-deep* wound. The fifth wound was on the thigh; it does not interfere with walking or standing; of course, is again only *skin-deep*. On the little finger is a wound nearly severing it. This was probably the most severe, and was so represented at the time. Besides these, some punctures were spoken of, but no particulars given as to their number or position. Now that these wounds were inflicted by a man intending murder, with a large military sabre, is certainly very difficult to believe. If the reports current at the time are to be credited, these injuries did not confine the duke to his house for a single day.

As to the suicide of Sellis, the arteries on both sides of the neck were severed. Is it possible for a man to inflict such a wound? There was blood about the room, upon the wash-

stand and basin, and in the basin a quantity of bloody water. Whence all these marks of blood? *Whose hands were washed in that bloody water?* Again, the razor was found two yards from the body to the left. It has been asserted, but never, I believe, proven, that Sellis was ambidexter. Again, his cravat was cut through. Do men usually omit to take off the cravat when they cut their own throat? Notwithstanding the white-washing verdict of a coroner's jury, the feeling in England was so strong against the duke that he soon went abroad, and I believe never resided for any considerable time in England.—C. R. G.]*

Arthur, Earl of Essex, was committed to the Tower on the 10th of July, 1683. This was during the reign of Charles II., and at the time when James, Duke of York, was supposed to have great influence in the government. On the 13th, (the same day that Lord William Russell was tried and capitally condemned), the earl was found dead in his chamber, with his throat cut. A coroner's jury was summoned, but before they were impaneled, the earl's body was taken out of the closet where it lay, and stripped of its clothes. These were carried away, and the closet washed, and when one of the jury insisted

* See the evidence and verdict in *Gentleman's Magazine*, 1810; also, in the *European Magazine*, and in the "News," a London daily paper of the time. I have not referred to the certificate of Sir Everard Home, which I think plainly untrue. He did not appear at the inquest.

I find the following quoted from the *Gazette Médicale de Paris*, but from the name of the reporter, suppose it may be an English case:—

Mr. Jameson was called to a female fifty years old, who had cut her throat with a razor. While attempts were made to staunch the wound she drew something from her pocket, to which she endeavored to attract their attention by signs, being unable to speak. Mr. Jameson took it out of her hands, and found it to be a considerable portion of the walls of the respiratory tube. It consisted of the cricoid cartilage entire, of the left wing of the thyroid, of the right arytenoid, of a part of the upper rings of the trachea and some fibres of the muscles of the larynx. The unfortunate female stated, by signs, that the mutilation was committed by herself, and that she had made five several attempts before she completed it. She survived thirty-four hours.

It is observed that if this female had died without any one being present to note the circumstances, they would unavoidably have induced a strong suspicion of homicide. How many would have credited the assertion that she had herself completed the horrid dissection and then removed the parts to her pocket? (*Encyclopedie des Sciences Méd.*, January, 1845, p. 241.)

upon seeing his clothes, the coroner was sent for into another room, and upon his return told the jury *it was my lord's body, and not his clothes, they were to sit upon*. Before the jury, two surgeons, Sherwood and Andrews, deposed as to the wound. Sherwood stated that the *aspera arteria* (the trachea) and the gullet, with the jugular arteries, were all divided. Andrews said that the throat was cut from one jugular to the other, and through the windpipe and gullet into the vertebræ of the neck, both jugular veins being divided. The verdict of the coroner's jury was suicide.

One Laurence Braddon, shortly after, formed the opinion that the Earl of Essex had been murdered by individuals who were allowed to pass by the earl's keepers, and who, he supposed, were set on by the Duke of York, afterwards James II. Braddon was tried for a misdemeanor in suborning witnesses to prove this, and was found guilty and fined £2000. After the revolution in 1690, he published a pamphlet entitled, "*The Earl of Essex's innocency and honor vindicated*," which contains some additional particulars.

The closet was about three feet two inches wide, and there was no blood higher than the floor. The instrument of supposed suicide was a French razor four and a quarter inches in its blade, and no spill or tongue at the end. Hence it must have been held by the blade, and it would seem difficult to inflict so large a wound with it. A surgeon is stated to have suggested to the coroner's jury, *that the notches in the razor were made by my lord against his neck bone*. Lord Essex was right-handed, and the razor lay on the left side. Two witnesses swore that the neck of his cravat was cut in three pieces, and there were five cuts on his right hand.

[Bishop Burnet insists that the earl (his personal friend) killed himself, and quotes the opinion of my lord's own surgeon, who said that the wound could not have been inflicted except my lord cast his head back all he could. This is mere nonsense, as Braddon well observes, for other men could pull the man's head back quite as far as he could cast it. This surgeon said the trachea was not cut, while the surgeons at the inquest swore it was. After the revolution, a committee of the House of Lords was raised, and before them two surgeons

swore that they had never seen such a wound self-inflicted, and did not believe it could be done. This committee, however, did not report. Most English historians concur with Burnet. Hume insists much on the melancholy temper of my lord, and his having upheld the rightfulness of suicide. This last is denied by Braddon, who also proves that the earl was very cheerful on Thursday evening. (He was found dead about nine o'clock next morning.) Hallam is unwilling to think that Charles or James could sanction such a crime. A person not under the amiable feeling of English loyalty, would, I should think, find it difficult to decide exactly what such a heartless profligate as Charles, or such a cruel bigot as James, would or would not do. I think no one can read Braddon's pamphlet without inclining to the opinion that the earl was murdered. The inquest was plainly a sham, facts were suppressed, the jury bullied till a verdict, *for which they were told the King was waiting*, was rendered. The investigation before the Lords' committee was arrested in a very suspicious manner, and finally came to nothing. Now, as Braddon says, men do not take so much pains to conceal facts unless they are aware that the truth will hurt them.—C. R. G.]*

No one at all acquainted with this subject will deny its intricacy. Chaussier, in commenting on the question, whether wounds are caused by suicide or homicide, quotes two cases from Ambrose Paré. One was of an Englishman, who was

* The authorities from which I have drawn the above narrative, are :—

The trial of L. Braddon, in Hargrave's *State Trials*, vol. iii. p. 855.

The Earl of Essex's innocence and honor vindicated, by L. Braddon, *ibid.*, vol. iii. pp. 899 to 934.

The Republic of Letters for August, 1735.

"Some passages sent by a person of honor to the author of the Republic," etc.

Burnet, vol. ii. pp. 212 and 234; and Smith, pp. 282 and 283.

There is also another pamphlet by Braddon, (published in 1725,) reprinted in Howell's *State Trials*, vol. ix. p. 1229.

Hallam's *Constitutional History of England*, American edition, vol. ii. p. 617; vol. iii. pp. 92, 435.

Braddon in his last pamphlet says: "Queen Anne, upon her first coming to the throne, struck me out of the civil list, because, as her majesty then said, I had thrown blood in her father's face." But, if innocent, why was not the parliamentary investigation completed?

robbed and wounded with a dagger, and left for dead at Vincennes. He was found in his shirt, with the trachea and œsophagus completely divided. Paré brought the trachea together, and dressed the parts so that the patient could articulate. He named his murderers, (who were taken and executed,) and died some three days after.

In another case a maniac inflicted a precisely similar wound on himself in the night, besides stabbing himself in various places. He was found thus in the morning, and his servant was arrested on suspicion. He also was so far recovered as to be able to confess that he had done it himself.

Now here were two cases of wounds precisely alike; yet one was suicidal and the other not. The collateral circumstances hence became very important; the one in a public, exposed place, the other in his bed, with his night-clothes uninjured, and in a disturbed state of mind.*

* *Chaussier*, p. 473. Two cases of suicide, from cutting the throat with a razor, are given in the *Annales d'Hygiène*, vol. iv. pp. 408, 414. In the first, related by *Marc*, the individual passed from his bedroom to the window of another adjoining, and there committed the act. There was no suspicious circumstance present; the wound was from left to right; but an aged physician, called in immediately after, had, in his agitation, stepped into the blood, and thus made footsteps to and from the bed of the deceased. This, with those who afterwards came, and were ignorant of the cause, produced suspicion.

In the other instance, by *Devergie*, the individual inflicted no less than three wounds before he could destroy himself, and they were two inches in depth, three inches and three lines in breadth, and exactly one foot in circumference. The narrative is accompanied with a plate, and our author justly observes that, were not the circumstances known, its infliction might with great probability have been ascribed to violence.

The following case also, which has been communicated to me by my nephew, Dr. Charles Sewell, of Montreal, as occurring not long since in Lower Canada, might well lead us to doubt, had not the general testimony been perfectly satisfactory as to its being one of suicide: A gentleman, aged sixty-seven, not suspected of insanity, in a lucrative employment, but suffering under domestic trouble, dismissed his carriage and servant at a short distance from his country residence. He put off his coat and vest, laid them on the turf, and on them his hat, containing his neckcloth and gloves. He made six slight gashes on the left side of his throat, and then appears to have gone on his knees, and bound the razor firmly to his hand with a handkerchief. There were two large gashes on each side of his throat. He must probably

On the 30th of March, 1826, between 6 and 7 P.M., a female was found dead in her cellar, with the throat cut. This must have occurred very recently, as she had been seen at 5 o'clock in the kitchen with her husband. The cellar was dark, deep, and difficult of access, and it communicated with a small interior one.

The body was found lying on the back, the head resting on the wall, and the feet directly at the entrance of the smaller cellar. The left hand was bloody up to the wrist. It lay on the left breast, and near the hand, apparently as if just slid from it, was a razor, bloody and open at right angles. The right hand lay on the ground, and near it was another razor, also open and bloody, but the hand itself was only spotted with blood.

The clothes in front, from the neck downward, were very bloody. The soles of the shoes were also stained with blood, but the upper parts had few or no stains of it.

In the smaller cellar, in front of the feet of the deceased, and about four feet from her, were her neck and pocket handkerchiefs, both bloody, and near them the ground was soaked with blood to the extent of about two square feet. In quantity it was estimated at about a pound. In the smaller cellar, on the left side of the wall, at the height of three feet four inches, were many spots of blood, apparently the sprinkling from a wounded artery. Spots of blood were also seen on the

have died instantly. The trunk had fallen forward, as the head was in the mud, but he was on his knees when found, and both hands were applied to the throat, one of them cut by the razor, which was still lashed.

A case occurred at the University College Hospital, under the care of Mr. Erichsen, of a man who attempted to destroy himself by cutting his throat. The patient is progressing favorably, but there is a peculiarity in the case which might have been of great importance had he succeeded in killing himself. It appeared that he seized the cutting instrument with both hands, and inflicted a wound on the *right* side of the neck. Now it is generally held that unless a man is *left*-handed, he cannot do this; and had the man died under doubtful circumstances, it might have been argued that the wound was inflicted by a second person, and suspicions might have been raised against perfectly innocent persons. Mr. Erichsen stated that a case of a similar nature was received into the hospital some years since. These facts are certainly of great value, and should be carefully noted. (Lancet, January 31, 1852.)

wall near the opening of this cellar, at the height of two and a half feet.

No part of the dress was disordered, nor were there any marks of violence on the body beyond the wounds of the neck. On removing the corpse for further examination, but little blood was found under the neck.

There were two wounds of the throat, one in front, below the lower part of the larynx, and in extent four inches. The thyroid gland was completely divided, and there were several cuts into it. The cricoid cartilage was cut, and there were marks of several gashes into the trachea; one at its upper part an inch long, and another transversely just below, which completely divided the trachea and opened the right carotid at its internal side. The lower part of the trachea was retracted about an inch. The second wound was only through the skin, a little to the left, and below the first.

On further dissection, the lungs were seen filled with black blood, and the trachea and bronchiæ obstructed by blood partly coagulated. The left side of the heart was completely empty.

Dr. Remé, the examiner in the first instance, inclined to the opinion of suicide, and supposed that she had inflicted the mortal wounds while on her knees, or sitting, and that afterwards, raising herself and taking a step or two, the blood from the artery had sprinkled the wall, while a portion of it, at the same time passing into the trachea, produced suffocation, and she fell back dead in the situation where she was found. Such was also the opinion of two medical men who were required to examine the disinterred body eight days afterwards. They supposed that different razors had been used for inflicting the two wounds, and that the repeated cuts in the trachea were the result of a want of resolution.

Notwithstanding these opinions, there were still circumstances sufficient to warrant a suspicion against the husband, and the court of assizes at Rheims required a report on the above facts from Messrs. Boyer, Antoine Dubois, and Adelon, of Paris.

Agreeing with the previous examiners as to the cause and mode (asphyxia and hemorrhage) of death, they differ decidedly from them as to the person inflicting the injury, and declare that, in their opinion, it is most probably a case of homicide.

The grounds of this opinion are the position of the body, the position of the razors, the number of wounds of the neck, their direction, depth, and situation.

The mortal wound, they assert, was given in the interior cellar. There the great mass of blood was found, and there the blood from the artery sprinkled the wall. Now this wound was of such a nature that syncope must follow where it was inflicted, and instead of falling backwards, if on her knees or sitting, she would fall forward. Yet the body is found out of the smaller cellar, six feet from the pool of blood, and lying on its back. But it is urged that she must have walked some steps, because blood is found on the soles of her shoes. No marks, however, of these steps were observed.

Again, on the supposition of syncope following suicide, and then falling backward, certainly some marks of contusion of the head should have been present, but these were wanting, while the outstretched position is very different from the demi-flexed state usually observed in those dead from syncope.

Situation of the razors. For similar reasons, the razors should have been found near the pool of blood. They fall immediately from the hands of a person inflicting a mortal wound on himself. That Dame C. should retain both these razors in her hands, and not drop at least one near the mass of blood, seems almost an impossibility. Suicides also, and in particular female ones, would hardly employ these instruments with the blade at right angles, but rather throw it out to its full extent. As to the *plurality of wounds*, they remark that generally, although not invariably, a single wound only is inflicted in cases of suicide, while here were repeated cuts into the cricoid cartilage and thyroid gland, and hackings of the trachea. It seems improbable that this female could have inflicted all these on herself.*

The *situation of the wounds* also contradicts the idea of suicide. Self-murderers usually make the incision immedi-

* Leuret, in a note, observes that suicides frequently inflict repeated wounds on themselves. In one instance, he knew seven wounds to be given with a knife, and in another, several deep gashes were made in order to open the jugular, yet after all these, the individual walked rapidly to his chamber, and there completed the self-destruction.

ately under the chin, but in this case it was at the lower part of the larynx. Even if we attach no importance to this, the direction at least is extraordinary. It is not traverse, nor a little oblique, each of which are common, but it is so obliquely perpendicular that the first eight rings of the trachea are not only divided, but their anterior portion is separated from the posterior. Now the eighth ring of the trachea is concealed behind the sternum, and it is difficult to conceive how a suicide could cause the razor to penetrate thus deep, and particularly as Mrs. C. is supposed to have made this with her right hand. On moving it, the right clavicle would of course be raised, and render approach still more difficult. Many of the divided parts are also hard or cartilaginous, and need considerable force to divide them. Lastly, it is remarkable that the right hand, used in inflicting the mortal wound, should have received so little blood in comparison with the left.

Such was the argument on which the reporters grounded their opinion of the *probability* of murder rather than suicide being the cause of Mrs. C.'s death. The result of the case is not given.

Adelon, in a subsequent review of the facts, which accompanies the narrative, inclines still to his original opinion, although with a diffidence becoming its uncertainty, and he candidly remarks, that a satisfactory solution is among the most difficult problems in medical jurisprudence. He concedes that a satisfactory answer has been given to one objection. The carotid artery was opened *inwardly*, and necessarily the jet of blood from it would cover the left hand much more than the right.

I have been thus particular in presenting the details of this interesting case, as it furnishes a model for similar investigations, and indicates many points of inquiry which might otherwise escape the attention of the medical witness.*

I proceed now to give some cases of undoubted homicide. The first is taken from the notes of Sir John Maynard, and occurred in the fourth year of Charles I., in Hertfordshire.

Jane Norkott was found dead in her bed, her throat cut, and

* Annales d'Hygiène, vol. xv. pp. 394 to 435.

the knife sticking in the floor. Two females and a man slept in the adjoining room, and they deposed that the night before, she went to bed with her child, her husband being absent, and that no person after that came into the house. The coroner's jury gave a verdict of *felo de se*. But a suspicion being excited against these individuals, the jury, whose verdict was not yet drawn up in form, desired that she might be taken up; and accordingly, *thirty days* after her death, she was taken up, and the jury charged them with the murder. They were tried at the Hertford assizes, and acquitted, but so much against evidence, that Judge Harvey let fall his opinion, that it were better an appeal were brought than so foul a murder should escape unpunished; and accordingly an appeal was brought by the child against *his father, grandmother, aunt, and her husband Okeman*.

The evidence adduced was, "that she lay in a composed manner in her bed; the bedclothes not at all disturbed, and her child by her in bed. Her throat was cut from ear to ear, and her neck broken. There was no blood in the bed, saving a tincture of blood on the bolster whereon her head lay, but no substance of blood at all. From the bed's head there was a stream of blood on the floor, which ran along until it ponded in the bendings of the floor. It was a very great quantity, and there was also another stream of blood on the floor at the bed's foot, which ponded also on the floor to a very great quantity, but no continuance or communication of blood of either of these two places from one to the other, neither upon the bed, so that she bled in two several places; and it was deposed that, on turning up the mat of the bed, there were clots of congealed blood in the straw of the mat underneath. The bloody knife was found in the morning sticking in the floor, a good distance from the bed: but the point of the knife, as it stuck, was toward the bed, and the haft from the bed. Lastly, there was the print of a thumb and four fingers of a left hand.

"*Sir Nicholas Hyde, C. J.* How can you know the print of a right hand from that of the left in such a case? *Witness.* My lord, it is hard to describe; but if it please the honorable judge to put his left hand upon your left hand, you cannot possibly place your right hand in the same posture; which being

done, and appearing so, the defendants had time to make their defence, but gave no evidence to any purpose."

The jury brought in all guilty except Okeman, and they were executed, but made no confession.*

Whether these were the guilty persons or not, it is certainly proved most incontestably that the female was murdered.

In several cases of late years, medical witnesses have been successful in detecting not only murder, but also its manner, by an examination of the dead body, even when in a state of putrefaction or decay. I have already noticed some of these in a previous section, and will now refer to a few others.

A man named Beaugouin was murdered, cut in two, and his remains thrown into the Loire. The upper part was found at some distance, and interred. On being taken up, fifteen days

* Hargrave's State Trials, vol. x. Appendix No. 2, p. 29. [The gravity with which the good Sir John gives the following details is "easy to praise, but hard to imitate." An ancient and grave person, minister to the parish where the deed was done, being sworn, did testify—that the body being taken out of the grave thirty days after death, and being touched by Okeman's wife, the brow of the dead, which before was of a livid and carrion color, began to have a gentle sweat upon it, which increased, till it ran down the face; then the deceased opened and shut one eye three times; she likewise thrust out the ring finger and drew it back; the finger also dropped blood upon the grass. The brother of the witness, also a minister, confirmed this evidence.

Testimony as to the bleeding of the body at the touch of the murderer was adduced on the trial of Standfield. (Hargrave, vol. iv. p. 283.)—C. R. G.]

Thatcher's Indian Biography, vol. i. p. 158.

On this subject, see Metzger, p. 328, and Valentini, Novellæ, Appendix 3. *De stillicidio sanguinis in hominis violenter occisi, cadavere conspicui, an sit sufficiens præsentis homicidæ indicium.* Within a few years, however, a great mass of learned and curious information has been collected by Mr. Pitcairn, in his "Criminal Trials in Scotland, from 1488 to 1624." The trial which led him to this investigation was the remarkable one of the Mures, of Auchindrayn, in 1611, for murder, in which occurred "the ancient and almost universal superstition, that the body of a murdered person bleeds at the approach, or at least at the touch, of the murderer." Mr. Pitcairn, (vol. iii. p. 124,) in his notes, gives many interesting illustrations of the origin of this mode of ordeal, as well as cases in which it is stated to have been employed.

Every reader of Scott's novels will recall the striking description, in the Fair Maid of Perth, of the ceremonies that accompanied the ordeal by touching, so admirably adapted to rouse the fears of the criminal, and even to work on the feelings of the innocent.

after, Dr. Ouvrad found that the cartilages between the third and fourth lumbar vertebræ had been cut. The lower portion exhibited several wounds of the abdomen. Dr. Ouvrad came to the conclusion that either an anatomist, or a person conversant in such disarticulations, had committed the act. There was, however, no doubt of this being murder, and he therefore supposed that a butcher was the criminal. Such proved to be the fact. Within a short time, the murderer was taken and executed.*

In 1814, an individual named Augustus Dautun was murdered in Paris. His body, cut into four or five parts, was found at various places in the Seine; the head had contusions on it, and there were wounds in the chest. The various portions were carried to the Morgue, and a model in plaster was taken of the bust. Through these means the body was finally recognized. Dupuytren was the principal examiner, and his reports are well characterized by Marc as models. The most striking circumstances by which the identity of the body was ascertained were, the existence of a wart on the upper lip, and an examination of the bones of the thigh, by which he proved that the individual had been lame. "He must in his infancy have had disease of the two articulations of the thigh with the pelvis. This disease, though of old standing and cured, had left a remarkable deformity about the lower part of the trunk, and the individual, in walking, must have probably been lame, or certainly there was an unpleasant balancing of the body on the lower limbs." All these circumstances had actually been present.†

The wound in the chest was found to have penetrated to the heart; it was larger within than at the surface, and indeed a second wound was discovered in the aorta, two inches higher than the other. From these circumstances, they supposed that a second blow had been given with the dagger before withdrawing it, and merely by altering its direction.

* Orfila's *Exhumations*, vol. ii. p. 336. Several additional cases are related where fractures were found on the dead body.

† He further completed the proof of lameness by examining the palm of the hand. This was found hardened, as if from the constant use of a crutch. (*Devergie*, vol. ii. p. 930.)

A brother, Charles Dautun, was ascertained to be the murderer. He implicated Girouard, a companion in debauchery, as an accomplice, but this was denied, and Girouard escaped, apparently from the want of decisive testimony. Dautun was found guilty and executed.

On the trial, Dupuytren was asked if any marks on the dead body could indicate whether the murdered person had been attacked by one or more persons. He replied by begging the court not to give to his conjectures more weight than they deserved. All he could say was merely probabilities, but it appeared to him that a plurality of persons had been engaged in the murder, and for the following reasons: When a man is struck, his first act is to present his hands as a defence against the blow. Now in this case there was not the slightest mark of injury on them. The same person that inflicted all these wounds could not at the same time have held them. Again, the wounds on the head must have preceded those on the chest. These were mortal, the thorax containing four pounds of blood. While the hands were held, might not the head have been interposed to prevent the wounds in the chest?*

In a case of homicide by cutting the throat, the facts adduced to prove it were, the inability to find a cutting instrument near the body, the number of cuts on and about the neck, some very deep, and some along the chin. The posterior part of the head was also wounded. And even admitting that the deceased himself could inflict all these wounds, it involved the absurdity

* *Causes Célèbres du XIX. Siècle*, vol. i. p. 400; *Annales d'Hygiène*, vol. i. p. 464; *London Med. Gazette*, vol. xix. p. 213. Zerah Colburn, in the memoirs of his life, states that he was in Paris, and saw Dautun led to execution. He mentions the mode of his detection, which I do not find in either of the above reports: "In the teeth of the dead body, tightly compressed, was a piece of human flesh, apparently torn out in the dying struggle. After some time, Dautun was gambling at the Palais Royal, and becoming angry, threw a glass at the waiter. It was shivered into pieces, and a fragment was carried into Dautun's wrist, under the cuff of his coat. The spectators wished to examine the injury, but he obstinately refused. At last, suspecting something mysterious, they pushed up the sleeve by force, and there beheld a scar recently healed, as if made by the tearing out of flesh. The landlord had been at the Morgue and seen the plaster model. He therefore delivered him to the legal authorities as probably the murderer."

of his being obliged to shift hands; some could alone be made by the right and the others by the left hand. From the presence of wounds of the hand, it is probable that there was some struggle.*

The remains of an individual named Ramus were, in 1832, found either in the Seine or in drains. They were collected, as usual, at the Morgue, and examined. It was ascertained that the body had been cut into four parts. Beyond this, however, it did not bear any marks of severe injury. A few superficial wounds only appeared on the face and eyelid. The skin and muscles were much retracted at the various sections, and particularly at the top of the thigh; the blood-vessels were completely empty; the heart was collapsed, and so light in color that it seemed to have been washed. The lungs were empty, except of a little serosity and air.

Now, from the absence of wounds, it was evident that Ramus had not been in a condition to offer much resistance; and accordingly, on proceeding to analyze the contents of the stomach, the presence of prussic acid was unequivocally established. I shall hereafter detail the experiments. It was, therefore, a probable supposition, that while laboring under its effects, the head had been cut off. That this was done during life, seemed evident from the bloodless state of the vessels. The division of the other parts must have been made at the same time, or immediately after death.†

The Edgeware Road Murder. Early in January, 1837, the trunk of a female was found in the Edgeware Road, London. The head had been severed above the sternum, and the fifth cervical vertebra was sawn through, leaving only about the tenth of an inch of that bone. The legs were cut off immediately under the hip-joint. There were no marks of violence on the body, except a superficial cut on the right side of the abdomen, two inches above the groin, and about an inch and a half in length. There were no marks present of medical treatment; she had not been bled or blistered recently.

* *Annales d'Hygiène*, vol. viii. p. 371.

† *Annales d'Hygiène*, vol. ix. p. 338; *Lancet*, N. S., vol. xii. p. 243. Subsequently, M. Lelut has noticed the same retraction of the skin, muscles, arteries, and nerves in persons guillotined. (*Devergie*, vol. ii. p. 184.)

On opening the body, the viscera were found completely emptied of their blood; there was no congestion in the lungs; no coagula in the heart; no blood flowed, nor were there any bleeding spots in the liver or spleen when cut into. All these organs were healthy. The stomach was about a third part filled with fluid and half-digested matter. Chyme was observed in the lower bowels, and the lacteals were filled with chyle. Dr. Hunter Lane examined the contents of the stomach and intestines, but could find nothing deleterious in them.

From the above circumstances, Mr. Girdwood, the medical examiner, inferred that the age of this person was between thirty and forty, and her height, (judging from the measurement of the spine), probably five feet eight inches. From the bloodless state of the body, he supposed that mutilation must have taken place shortly after death; and further, that her death must have been sudden, and in all probability not preceded by disease. Even if it had been apoplexy, still the throat must have been cut very soon after death, in order to account for the bloodless state of the viscera.

Shortly after this the head was found in the canal, near *Mill End*, seven miles from the former place. It corresponded with the body. The face was very much bruised and wounded. The left under-jaw was fractured, and the right coronoid process was also broken. Around the right eye was a broad ecchymosis, extending downward as far as the end of the nose. The cheek under the eye was puffy, and the eye itself was wounded and ruptured, and all the humors had escaped.

There were several wounds on the cheeks, mouth, right eye, and scalp, which had no ecchymosis around them. The brain was healthy, but empty of blood.

Lastly, after an interval of some weeks, the legs were found in a parcel at Camberwell, also seven miles distant from each of the above places, (so that the murderer must have traversed twenty-one miles.) They were readily identified as belonging to the same person, and presented only slight indications of commencing decomposition. There was scarcely any discoloration, but there was a gash under the right knee, not ecchymosed.

These repeated examinations, and the publicity given to them, finally led to the discovery of the murderer, and the name of his victim. She proved to be a Mrs. Brown, who was shortly to have been married to her destroyer, Greenacre. The inferences drawn from the medical examination were proved to be correct by his confession. She came to see him, and they quarreled; he struck her with a rolling-pin, and she fell down, either dead or insensible; in about an hour afterwards he dismembered the body, and removed its parts to the different places where they were found.

The medical testimony of Mr. Girdwood and Mr. Bartwhistle in this case is highly creditable to them, and the opinions they advanced, particularly as to the wounds inflicted during life and after death, evince accurate discrimination. Greenacre was executed.*

I will only add a case of murder by fire-arms:—

C. D., residing in the same house with his sister-in-law, suddenly disappeared. After a course of judicial researches, his body was found buried in a cemetery, wrapped in ten folds of linen, and with his clothes on, covered with blood. In his left side were two round holes, distant about five inches from each other. The medical examiners reported that one of these penetrated from side to side, so as to take off a part of the right breast, and on pursuing the dissection, the ball was found to have entered at the last true rib of the left side, to have passed the stomach, of which it wounded the upper part, and to have pierced the duodenum with a wound five inches long, and finally to have passed out at the first false rib of the left side. Corresponding holes were found in the clothes and shirt, and they therefore gave it as their opinion that these wounds had been inflicted by fire-arms, and were the cause of death. On this, the sister-in-law of the deceased was arrested, as the

* London Med. Gazette, vol. xix. pp. 551, 584, 587, 748; vol. xx. pp. 128, 138; London Atlas (newspaper) of April 16, 1837. It is also worthy of mention that, in this murdered female, the external organs of generation were not larger than those of a child nine or ten years old; there was no hair on the pubis; the labia were preternaturally small, the vagina was not more than two inches long, while the uterus was wanting, and in its place was found a small triangular, cartilaginous membrane, without any cavity.

clandestine burial, together with the wrapping up of the body, led to doubts concerning her innocence.

Pelletan and another surgeon were consulted on the case. They agreed that no doubt could exist as to the cause of the death being a wound from a fusée; but they at the same time affirmed that the deceased might have inflicted it, either voluntarily or involuntarily, on himself, and that another person could not have done it without being in an ambuscade, with his knee on the ground, and the deceased walking. From these circumstances, they were of opinion that the sister-in-law was not the murderer, if murder had been committed.

On this decision, we may remark with Foderé, that it seems difficult that a wound inflicted in this manner, and nearly in a horizontal line, could have been caused by suicide; while again, the sister-in-law, though not the actual murderer, might, notwithstanding, have been an accessory. She was, however, acquitted.*

In connection with the subject of this section, it is sometimes

* Pelletan, vol. i. p. 306; Foderé, vol. iii. p. 199. The following incidents occurred at Bordeaux, in July, 1835: An individual, aged more than sixty, of good property, cheerful temperament, and with scarcely any causes of chagrin, dined with his only son, and with whom he was on excellent terms. They were both free drinkers of wine, and after dinner the son threw himself on his bed, which was adjoining that of his father, and slept. He was awakened by the discharge of a pistol.

The father was found to have blown away his face and part of his skull. He was sitting in an arm-chair, the left elbow on it, and in the right hand was held a discharged pistol, which rested on the inside of the right thigh in such a manner that the slightest motion would cause it to fall to the ground. There was a large quantity of blood in the arm-chair and on the floor.

A suspicion of parricide was soon engendered. The son might be desirous of enjoying his father's property; but, in particular, the position of the pistol was deemed ambiguous. Ought it not, by its own specific gravity alone, to have fallen to the ground after the infliction of the death-wound? and was it not possible that, if murder had been committed, it had been placed in its present place?

The medical examiners rebutted this idea by stating that contraction of the fingers often remained for a time after death, particularly when, as in this instance, the weapon must have been firmly held. Having thus disposed of the most important circumstance, they concluded, from the absence of any marks of violence, the relative condition of the parties, and the temporary insanity often induced by intoxication, particularly in summer, that this was a case of suicide. (*Annales d'Hygiène*, vol. xv. p. 467.)

of great importance to ascertain whether spots found on offensive weapons, clothing, or articles of furniture, are those of BLOOD. Modern chemistry has solved the problem.

[Lassaigne, Chevallier, and Orfila, are the chief authorities. The chemical characteristics of blood are,—

1. It is readily dissolved out by clean cold water, to which it gives a rich red color.

2. This color is destroyed by boiling, which throws down a muddy-brown flocculent precipitate.

3. This precipitate, when collected on a filter, has a blackish resinous appearance, is entirely insoluble in water, but soluble in boiling caustic potash solution, to which it gives a green color.

4. The solution in cold water (No. 1) is not turned green nor crimson by a few drops of liquor ammoniæ, but, in excess, the alkali strikes a brownish tint. Although theoretical objections have been started against these tests, it may safely be asserted that there is no red coloring matter which they will not distinguish from blood. In no one shall we find the same ready solubility in cold water, the same negative result when ammonia is added, and the same destruction of the color by boiling. Caspar expresses great confidence in Hoope's method of treating recent or washed-out blood stains by caustic soda. Caustic soda, when dropped on recent blood or blood stains which still contain traces of hæmatin, produces in a few minutes a pale or dark olive green passing at once into the previous red or reddish or yellowish-red color when acetic acid is dropped upon it, and again becoming green when treated with fresh soda. There is no other coloring matter which undergoes these changes when thus treated. The diicroisms developed by concentrated sulphuric acid, though very curious, are of less forensic value, as the same diicroism is developed in albumen, bile, and even in fat. Teuhman's discovery of the salts of hæmin developed by glacial acetic acid is of the greatest forensic value, as by it blood can be recognized on stuffs so rubbed and washed as to render the discovery of the corpuscles impossible. His process has been greatly improved by Simon and Buchner, and is as follows: Mix a drop of blood or bloody fluid in a watch-glass with an excess of glacial acetic

acid, then slowly evaporate, put the dried mass under a microscope and innumerable crystals of hæmin are at once seen, rhomboidal, tabular or otherwise, color yellowish or yellow red or blood red, of various sizes, often placed over each other in a cruciform or stellated manner.

Satisfactory as these chemical tests, when carefully tried, undoubtedly are, yet most important corroborative evidence can be obtained by the microscope, by which the blood corpuscles can be detected. To evidence from this source it has usually been objected that the investigation is very unsatisfactory, unless in the hands of microscopic experts. This objection has now fortunately lost most of its weight, since the microscope has come into such very common use among the better educated members of the profession. Little difficulty need now be experienced in finding in any large community more than one physician who could with great certainty identify the blood corpuscles under the microscope. Let any stain be dissolved off a weapon or an article of clothing with a cold solution of white sugar, of the sp. gr. 1.03, and a drop of the fluid thus obtained examined with a power of 300, and if it be blood, the corpuscles will be easily detected. Care should be taken not to rub the cloth or other material, nor to continue the maceration too long, (ten minutes will generally suffice,) or the corpuscles may be so broken up as to render the microscopic examination unsatisfactory.—C. R. G.]

Dr. Ollivier suggests that in doubtful cases it would be well to examine any portion of hair that may be seen attached to weapons. On viewing human hair through a microscope of the power of 150 and upwards, the distinctive characteristics of human hair are easily made out—for greater certainty examinations should at the same time be made of (undoubted) human hair, and that of the more common animals.

Foot-prints. M. Mascart, in 1843, presented a paper on the subject to the Royal Academy of Belgium, and he is the only writer I am aware of that has noticed it.

He asserts that the foot-print on the ground is generally smaller than the foot that made it, but he allows that there are exceptions, and that even the print may be larger than the foot.

[The following case may, perhaps, be as appropriately in-

troduced here as elsewhere; the lesson it conveys is too important to allow of its being omitted. It was communicated by Dr. James Reid to Dr. Grey, and is given in his own words: I was sent for one day to a man and his wife, whom I found lying on the same room with their throats cut. The woman lay upon the floor, with her right arm under the bed, and a razor close to her right hand. Her throat was cut deeply from ear to ear, and she lay in a pool of blood. Her husband, who was in bed, had received a wound in the throat, dividing the trachea, but not wounding any important vessel, and without causing any great flow of blood. He gave the following account: In the middle of the night he was aroused from sleep by receiving a wound in the throat from the hands of his wife. The shock, the wound, and the loss of blood together had prevented him from making any resistance, or giving any alarm. My suspicions were aroused, partly by the man's manner, and partly by observing the water in a basin standing in the room slightly tinged with blood. In endeavoring to find some confirmation of my suspicions, a thought struck me. I turned up the bed-clothes, and found the sole of the foot covered with dried blood. I stated this fact to the jury at the inquest; a verdict of guilty was immediately returned, but the man died almost at the very moment that sentence was passed.*—C. R. G.]

* Grey, Med. Jur., p. 278.

CHAPTER XIV.

PART II.

PERSONS FOUND DEAD.—(*Concluded.*)

F. OF PERSONS FOUND DEAD FROM NOXIOUS INHALATIONS. 1. Carbonic acid gas—modes in which it may be generated—symptoms and effects—appearances on dissection. 2. Sulphureted hydrogen—effects—appearances on dissection. G. OF PERSONS FOUND HUNG. Modes in which death occurs. Signs of strangulation by hanging—notice of the value of each—appearances on dissection. Whether the person found hung has been suspended before or after death—cases. Whether the hanging is the result of suicide, accident, or homicide—cases. H. OF PERSONS FOUND STRANGLED. Whether this has been actually the cause of death—cases—appearances on dissection. Of manual strangulation. Whether the strangulation is the effect of suicide, accident, or homicide—cases. Strangulation detected long after death. J. OF PERSONS FOUND SMOTHERED OR SUFFOCATED. Infants, by accident—adults, by accident, homicide or suicide—cases. Death from pressure in a crowd. K. OF PERSONS FOUND DROWNED. Modes in which death is produced. Signs that distinguish death previous to submersion from death after it—examination of the relative importance of each sign. Effects of immersion on the dead body, and the changes produced by it—floating of the body—formation of adipocire—progress of putrefaction at various periods—cases. Whether the drowning was the effect of suicide, accident, or homicide—cases.

F. Of persons found dead from noxious inhalations.

A VAST proportion of the gases discovered by modern chemists are irrespirable. Few, however, are spontaneously generated, and their noxious power must of necessity be extremely circumscribed. We shall notice such as have proved directly destructive to life, under the head of poisons. But there are some which are occasionally the results and accompaniments of peculiar situations and occupations, and of these, the most remarkable are carbonic acid gas and sulphureted hydrogen. It must, however, be understood, that in many

instances where they prove deleterious, other poisonous substances may co-operate in causing the result. This fact, in conjunction with the comparative frequency of injury from them, fully justifies a notice in this place.

1. CARBONIC ACID GAS is generated in various ways. 1. *By respiration.* When a number of persons have remained during a long time in an apartment, or any other place where the air is not renewed, they vitiate the air by the process of respiration, and the poison in question accumulates. The most striking and melancholy instance of this occurred at Calcutta, in 1756. When that place surrendered to Shujah Dowla, he thrust one hundred and forty-six Englishmen into the *black hole*, at Fort William, a place only eighteen feet by fourteen, and having only two apertures through which air could be admitted. They remained here from eight in the evening until the next morning, when only twenty were alive. A somewhat similar instance of brutality happened in London in 1742. Twenty persons were forced into a part of St. Martin's round-house, called the *hole*, during the night, and in consequence several died.* Individuals in a state of suffocation from this cause are seized with an insupportable thirst. A copious perspiration is present, and great pain in the chest, difficult respiration, and intense fever follow. They lose their strength, and fall into a deep lethargy, to which death soon succeeds if aid be not speedily given.†

2. *By combustion of charcoal.* According to Orfila, the air, when charcoal begins to burn, contains in the 100 parts, 14 of carbonic acid gas, 20 of atmospheric air, 52 of azote, and 14 of carbureted hydrogen. But when the charcoal is in a state of perfect ignition, the air evolved in the 100 parts, consists of 42 azote, 46 common air, and 12 carbonic acid. The correctness of this analysis is doubted by Devergie—First, because it shows less of carbonic acid when the charcoal is in full combustion than when merely igniting; and secondly, because the presence of carbonic oxide is wanting, a product which, from the nature

* Smith, p. 206. Horace Walpole's *Letters to Sir Horace Mann*, vol. i. p. 169. The keeper of the round-house was tried, but acquitted of willful murder.

† Orfila's *Directions*, p. 170.

of the substances acted upon, we should at least imagine to be present in some proportion.

I need hardly state how frequently this proves to be a cause of death. Persons on going to bed, leave pans of it burning in their apartments, and in the morning are found lifeless.*

3. *By the burning of limestone in kilns*, where it is often destructive to persons who resort to such places for warmth. Two cases of this kind are given in the Ed. An. Reg., vol. vi. part ii. p. 64, and one by Dr. Bird, Guy's Hosp. Rep., vol. iv. p. 90.

4. *By fermentation*. Hence it frequently accumulates in wine vaults and beer-cellars.

5. *By vegetable decay*. Wet straw or saw-dust attracts oxygen from the air, and gives off carbonic acid. The gas also accumulates in vaults, wells, and in coal mines; in the latter, however, it is commonly mixed with carbureted hydrogen or fire-damp.

6. *Plants give off carbonic acid* during the night, and this may accumulate so as to be fatal to life. Dr. Paris gives a case where a gardener, watching plants, was found dead in the morning.†

7. *The combustion of wood, coke, and anthracite coal*, may prove fatal from the carbonic acid evolved.‡

* A large number of cases of this description is quoted by Dr. Dobson, in an essay contained in Percival, vol. i. p. 328. See also Philosophical Transactions, vol. lii. p. 454.

† Paris and Fonblanque, vol. ii. p. 49.

‡ Edinburgh Medical and Surgical Journal, vol. xxxii. p. 345. Case by Mr. Watson, of the workmen at the Wanlockhead mines, from the wood of a flue taking fire. Some of the symptoms are referable to the effects of sulphurous acid gas, which see under Poisons. (Lancet, N. S., vol. v. p. 174.) Case by Dr. Schenck, of two persons dead from the smoke of a forge. (Edinburgh Medico-Chirurgical Transactions, vol. iii. p. 543.) Dr. John Gairdner, on the deleterious effects of the smoke of coal, as illustrated in the cases of six individuals subjected to its influence. A coal fire had been kept up during the night, and the smoke produced by it had passed down another chimney into the bed-room, the door of which was, however, open. They awoke with dizziness, a reluctance to rise, stupefaction of mind, and a desire to return to sleep. When thoroughly aroused, headache succeeded, with vomiting or sickness at the stomach. They gradually recovered by the next day. (Christison, p. 692; Annales d'Hygiène, vol. xiii. p. 442.) A recent case by Devergie, of one individual dead and several dangerously ill from

Mode of action.—Carbonic acid is actively poisonous, and does not destroy life negatively by preventing the access of oxygen. The experiments of Martigny prove that a mixture of carbonic acid and oxygen, in the proportion in which the latter exists in atmospheric air, is rapidly fatal to animal life. Carbonic acid is rapidly absorbed from the air-cells, and enters the circulation. The following experiment by Martigny proves that it can also be absorbed by the cutaneous surface:—

In an experiment on himself, the body was inclosed in an atmosphere of this gas, with due precautions for the maintenance of breathing the external air, yet the symptoms were those usually observed from breathing it. Animals treated in this way died after some time.*

The earlier symptoms are a sense of weight, uneasiness or pain, often violent, in the head, ringing in the ears, giddiness, sometimes vomiting, a great disposition to sleep, a rapid loss of strength, so as to be unable to continue upright, a great difficulty of breathing. The senses are dull, and there is a partial or total loss of sensibility.

In advanced stages, the breathing is occasionally stertorous, and froth issues from the mouth. Coma is perfectly established,

the gas issuing from a smouldering beam that was heated by the flues of a kitchen chimney. The individuals attacked were in an upper room; on removing the boards and giving access to the air, the beam took fire.

I will add to these the following curious case: On the 12th of May, 1650, some forgermen at Leipsic were drinking in a chamber where a child, twelve years old, was asleep. They amused themselves with passing a half extinguished candle under its nose. The child awoke, but again fell asleep, and they continued this course for half an hour. It was shortly after seized with convulsions or epileptic fits, and died in three days. The parents complained of this to the magistrates, who consulted the faculty of medicine. They answered that the fumes of a candle were identical with the vapors from charcoal and lime, and would produce the same deleterious effects. (Valentini's Pandects, vol. i. p. 195.)

* Edinburgh Medical and Surgical Journal, vol. xxix. p. 214. His experiments are also given in full in American Medical Recorder, vol. xiii. p. 296. See also, Mr. Snow's experiments in Lancet, N. S., vol. xxiv. p. 93, and Dr. Golding Bird, in London Med. Gazette, vol. xxiii. p. 924. "Carbonic acid diluted (as in charcoal vapor) may produce death, although a proportion of oxygen, sufficient *per se* to support life, may be present in the air of the apartment."

interrupted briefly, in some instances, by delirium, and in others by slight convulsions. But the last are rare.

If bodies are discovered after the gas has had its full operation, the following are the most common appearances: The head, face, and neck are swollen; the eyes are protruded from their sockets, but preserve their brilliancy often for two or three hours after death; the tongue is thrust out, swollen, and inclined to one side of the mouth; the jaws are firmly closed; the face livid; the lips of a dark-blue color; the abdomen inflated, and sometimes violet-colored discolorations are seen even on the anterior parts; the body preserves its warmth for a length of time, and sometimes, indeed, is warmer than natural, while the limbs remain flexible for some hours. These phenomena, particularly the latter, succeed each other more rapidly in summer than in winter.

Let it, however, be distinctly understood that these appearances are far from being invariable. The countenance is often pale, probably in a majority of cases, and generally bears few marks of suffering. From an analysis of a large number of narratives, Dr. Bird infers, as an extremely constant occurrence, the intensely calm and sleep-like aspect of the corpse, whether pale or bloated. Dr. Ollivier suggests that the variety noticed by observers as to the appearance of the countenance, may depend on the period after death when the examination is made. If early, paleness will be most common, but after a few hours, the violet tint will frequently be seen. Again, frothing from the mouth and nostrils is sometimes absent, the limbs are sometimes rigid, the eyes natural, and the tongue, if vomiting preceded death, is behind the teeth.*

* Struve, p. 52; Belloc, p. 184. The discolorations noticed above are confined to the mucous tissue of the skin, but pervade its whole thickness. On cutting into it, Devergie found a number of small red points, produced by the blood settling there. Vol. i. p. 85.

Dr. King, in *Edinburgh Medical and Surgical Journal*, vol. vii. p. 180. History of three cases. Here the fingers and toes were curved, and the nostrils dilated.

Cyclopedia of Practical Medicine, art. *Asphyxia*, by Dr. Roget.

London Medical Repository, vol. xxvii. p. 468.

London Medical Gazette, vol. xv. p. 601. This is a remarkable case of

So, also, with the appearances found on dissection. The blood-vessels, and particularly those of the head and lungs, are found filled with blood, and it is principally accumulated in the right side of the heart and the veins leading to it. Effusions of serum, sometimes tinged with blood, are frequently seen, particularly in the ventricles of the brain and in the bronchiæ. It is commonly stated that the blood is black, and so fluid that it is discharged readily from the smallest incision. This, however, is not now deemed a constant occurrence. Out of a number of cases examined by Ollivier, in 1837, he found the blood red in five. Dr. Marye confirms this, and the last also found the blood drawn from a vein during life, in a person asphyxiated with charcoal, to be red. Each of these observers has also noticed it to coagulate promptly, and Dr. Bird states that this was noticed in six cases out of ten analyzed by him. Still, in a majority of instances, the contrary occurs, and the only proper inference is, that we cannot depend on the above appearances as diagnostic marks.

Dr. Ollivier states that the red color of the blood occurs only in those who are speedily poisoned, but gives no satisfactory reason.

As occasional occurrences, may be named a softness of the

suicide in Paris. The external appearances correspond exactly with those given above as most common; but it is probable, from the signs of sickness of the stomach and the presence of urinary and fecal discharges, that there must have been some suffering.

Ibid., vol. xxiii. p. 922, Dr. Bird on the phenomena of death by carbonic acid gas.

Guy's Hospital Reports, vol. iv. p. 75, Dr. Bird's cases of poisoning by the vapors of burning charcoal and coals.

Boston Medical and Surgical Journal, vol. xix. p. 325, two cases of imminent symptoms, but the patients recovered. Related by Dr. Plympton.

Annales d'Hygiène, vol. xx. p. 114, Ollivier (D'Angers) on Asphyxia, by carbonic acid.

London Med. Gazette, vol. xxvii. p. 693. Case by Mr. Collambell. Death occurred in two hours from burning charcoal. The countenance was pale, and frothy mucus escaped from the mouth. The appearances on dissection corresponded to the general description. Dark fluid blood in the head and lungs, but the heart empty. Effusion of serum was also present in the same organs in the bronchiæ.

muscles, so as to be torn by the slightest exertion; the epiglottis raised, and sooty matter in the nostrils and trachea.*

The larynx and trachea are usually injected with blood, and of a rose color.†

As a variation from the ordinary appearances, it may be mentioned that Renard, in three cases, found the right side of the heart empty.

Although the causes which produce death in these cases are often evident, yet dissection should never be omitted in any case. It may aid us materially. We should notice whether any marks of injuries are present, which may excite doubt. The place, the circumstances under which the body is found, the noxious material that has been inhaled, all deserve investigation, and may lead to the truth.‡

[The question is often asked, what proportion of carbonic acid gas renders atmospheric air dangerous or fatal? Pure carbonic acid gas is entirely irrespirable, and if an animal be plunged in it the glottis is spasmodically closed, and life is destroyed by simple asphyxia. Here the carbonic acid acts negatively, preventing the access of oxygen, but not producing

* Portal, in *Medical Commentaries*, vol. iii. p. 254; Belloc, p. 184. Dr. Babington's case of exposure to the vapor of burning charcoal, in *Medico-Chirurgical Transactions*, vol. i. p. 93; Orfila's *Toxicology*, vol. ii. p. 347; Larrey, vol. ii. p. 128.

Dr. Bright's *Dissections*, in *Medico-Chirurgical Review*, vol. xx. p. 4, of two sailors suffocated on board of a vessel. I presume these are the same mentioned in the *Lancet*, N. S., vol. i. p. 553, as occurring at Guy's Hospital. The vessels of the dura mater were filled with blood, and the sinuses gorged with it in a fluid state. The heart and its vessels were in a similar state, and the mucous lining of the bronchiæ beautifully injected. Christison, p. 712. He refers to a case by Mertzdorff, where, in addition to the usual appearance, there was a general diffusion of blood between the arachnoid and pia mater. Taylor, on the phenomena of suffocation from carbonic acid, copied in the *American Journal of Medical Sciences*, vol. i. p. 219.

† Briand, (third edition, p. 520,) in noticing the high-colored state of the mucous membrane of the larynx, trachea, and bronchiæ in these cases, observes that the redness is most manifest in the trachea, owing to the white color of its cartilaginous rings. He adds that there is often a capillary injection at the root of the tongue, and the papillæ there are much developed.

‡ Orfila remarks, that if the body of a person suffocated by a non-respirable gas or by strangulation, be cold or stiff, we may be certain that more than twelve hours have elapsed since death.

any specific poisonous effects. Sir Humphrey Davy attempted to breathe the pure gas, but found it impossible; great irritation of the fauces and spasmodic closure of the glottis occurred immediately. He mentions that the gas had an acid taste. The observations of others who have attempted this experiment do not confirm his statement as to any taste being perceptible. Thus much for the pure gas.

It is generally conceded that an atmosphere containing ten per cent. of carbonic acid will very promptly produce a fatal result. Allen and Pepys found that air once breathed came from the lungs containing eight per cent. of carbonic acid, and that however often it may be respired, it never contains more than ten per cent.* There is, however, reason to suppose that a much smaller proportion will destroy life. Mr. Coathorpe (*Lancet*, vol. xxxi. p. 261,) states that he suffered very severely from inhaling an atmosphere which, he calculated, contained no more than two per cent. In all the calculations made on

* *Annales d'Hygiène*, vol. xvii. p. 201; *London Med. Gazette*, vol. xx. p. 238; *British and Foreign Med. Review*, vol. vi. p. 244. The following remark by Dr. Christison, (third edition, p. 749,) deserves to be added in this place:—

“An observation worthy of note, as at times supplying the only rational explanation of the discrepant effects of the poison on several individuals simultaneously and to appearance alike exposed to it, is that in a close apartment the gas abounds most in the lowest part by reason of its high density, but that where a current from without is directed through the room, as for example, from below a door toward a fire or stove, the situation where least effect is produced may be exactly that which in other circumstances is the most dangerous, namely, on the floor.”

And, again, the following by Dr. Golding Bird, (*Guy's Hospital Reports*, vol. iv. p. 87:) “I feel inclined to believe that the reason why the fumes of vividly burning charcoal are found to be less injurious than those evolved by that fuel when in a state of slow combustion, may be traced less to the presence of a new or peculiar specific poison in the latter, than to the greater evolution of heat accompanying the former, causing a rapid circulation of air throughout the apartment, and the consequent dilution of the carbonic acid gas produced by causing it to mix rapidly with the atmosphere.”

In a more recent memoir, (*Annales d'Hygiène*, vol. xxiii. p. 190,) Devergie states his conviction, both from experiment and reasoning, that, however much the carbonic acid may be diffused through an apartment while the charcoal is burning and the air is heated, yet when cooling takes place, it will not remain mingled, but will sink, from its specific gravity, and form the lower stratum of air.

this subject, it should be remembered that the case where ten per cent. of gas is added to atmospheric air is very widely different from that in which ten per cent. of gas is formed in the atmosphere by combustion. In the former case we have ten per cent. of carbonic acid and ninety of pure atmospheric air; in the latter we have, to be sure, the same quantity of carbonic acid, but it has been formed at the expense of the oxygen of that very atmosphere which is rendered by it so much the less fit to support animal life. Another fact in this connection which it is important to state is, that the common notion that an atmosphere that will support combustion, in which, *e.g.*, a candle will burn, will support life. This is certainly not true. The percentage of carbonic acid which will extinguish a candle is differently stated: Cavendish gives ten per cent., Ure fifteen, Turner twenty, while, according to Dr. G. Bird, twenty-five per cent. was required promptly to extinguish a tallow candle which was thoroughly ignited and burning freely. Now it is certain that ten per cent. is promptly and certainly fatal to animal life. Experience has confirmed this view, for many persons have been found dead, and others have, with great difficulty been saved, where the air was pure enough to support combustion.

Another question which has been much discussed is, will the gas collect in the lower part of a room, so that a person lying on the floor may perish, while one standing or lying on a bed will escape? Whatever difficulty there may be in reconciling the fact with the well-established doctrine of the diffusion of gases, experience has decided this question in the affirmative, and proved that the lower stratum of air is generally more irrespirable than the upper. At the same time, there are many causes which may promote the diffusion of gases. Devergie, in an elaborate paper, (*Ann. d'Hygiène*, vol. xxiii. p. 176.) has given a summary of these causes, the most important of which are currents of air, as from under the door or from cracks in the windows, and elevation of temperature by the combustion which generates the gas. He found that, though diffused by the upward currents of heated air, the carbonic acid falls to the lower stratum of air when the room becomes cool. In the same journal, vol. xvi. p. 30, M. D'Arcet gives

some very interesting cases, illustrating the mode in which the gas may be transmitted from room to room, and even from one story of a house to another, either from above downward, or the reverse:—

Case 1. A young man was observed to lose strength and health, and experienced a certain degree of uneasiness when he entered his room. M. D'Arcet being consulted, found the room filled with the vapor of burning charcoal, which descended by the chimney of the saloon from that of a room above, with which it communicated, and in which fire was kept much of the time, fire being rarely kindled in the saloon.

Case 2. Two ladies were asphyxiated in their sleeping-room. The atmosphere was loaded with carbonic acid. On investigation, it was found that this gas descended through the stove-pipe and issued from the stove-door in such quantity as instantly to extinguish a lighted candle, there having been no fire in the stove for some time. The stove-pipe was inserted in the chimney, which communicated with that of a room in the story above. On knocking at this door, M. D'A. was met by a mechanical dentist, who had been all night busy baking artificial teeth in a furnace heated by charcoal.

Case 3. The sisters of Fourcroy resided with M. Vaguelin; they kept a dog, a cat, and canary-bird. On leaving for the country to pass two days, they supplied their pets with food and water, and left them confined in the antechamber. On their return the room was filled with smoke, the animals dead. It appeared that the smoke had entered the room by the stove-pipe from the chimney of the story above, where a fire was kept. Whether it had fallen by its own gravity or been drawn down by the descending draught created by the heated air of an adjoining room, it is difficult to say.

These cases prove the necessity of thorough investigation as to the possible sources of carbonic acid, where poisoning by that agent is suspected.—C. R. G.]

Case of L'Amoroux. In February, 1836, the body of Mad. L'Amoroux was discovered in her apartment. She had been dead only four days, yet putrefaction had far advanced; face much swollen, and with the body and limbs of a livid green. No external injury. On dissection, the lungs and liver were

gorged with blood, and softened by putrefaction: stomach healthy, containing no deleterious matter. Her husband stated that he and his wife had resolved on suicide; that they lay down upon the floor, and he placed a pan of burning charcoal between them. His wife died in three hours, but he remained unaffected. He then renewed the fire and kept it up for three days, intent on self-destruction. It was referred to a medical commission, to say whether it was possible that under these circumstances the husband could have escaped. They answered in the negative. The case was then given to Devergie to answer the following:—

Question 1. Did the state of advanced putrefaction in which this body was found, four and a half days after death, support or negative the idea of death from asphyxia? *Answer.* In cases of death from asphyxia, putrefaction comes on very slowly. He noted in one case the beginning of gangrene not till the eighth, and a green color of the limbs not till the thirty-fifth day after death. The trunk seemed to dry rather than to soften. The same tendency to desiccation in two bodies, a man and a woman, dead a month. The skin was generally yellow, green only at a few points.

Question 2. Ought the livid appearance common in the asphyxiated to have been seen here, notwithstanding the putrefaction? *Answer.* It ought.

Questions 3 and 4 related to the survivorship of the female, and the position on the floor, as favorable to a speedy death? M. Devergie has not, in his experience, found females die sooner than males in charcoal emanations; rather the contrary. As to the position on the floor, it was not favorable to speedy death, as, owing to the fire being kept up, currents of nearly pure heated carbonic acid would be constantly rising, and currents colder and less pure falling. L'Amoroux was found guilty. Though he may have intended to destroy his wife and save himself, there can be little doubt that she died asphyxiated by charcoal. The rapid putrefaction, etc. should be referred to the heat kept up for three days.

2. SULPHURETED HYDROGEN GAS. This is the principal noxious substance exhaled from privies and common sewers, and it has proved destructive to many.

Chaussier was among the first to notice its rapidly fatal effects, whether inhaled or injected into the cellular tissue or rectum. According to the experiments of Thenard and Dupuytren, the gas, even when mixed with a large quantity of atmospheric air, is a very powerful poison. A proportion of $\frac{1}{300}$ th was sufficient to kill a bird in very little time; $\frac{1}{800}$ th produced death in a dog, and a horse was killed in an atmosphere containing $\frac{1}{250}$ th part of it. Nyston and Broughton have verified these results, either by a repetition of the experiments, or by injecting it into the veins.*

"When the exposure has lasted but a short time, the sufferer experiences a general uneasiness, accompanied with nausea and sickness; his respiration becomes irregular, but not difficult, and his pulse much agitated; the skin is cold, general convulsions, almost tetanic, take place, the muscles of the chest

* Coxe's Medical Museum, vol. iii., app. p. 29, Exps. of Dupuytren; Christison, pp. 693, 698; Brande's Journal, N. S., vol. vii. p. 16.

Sulphureted hydrogen does not appear to be deleterious to man in an equal ratio. It has been found by accurate observation, that the workmen employed in the common sewers of Paris work without inconvenience in an atmosphere containing one part of sulphureted hydrogen in 100 of atmospheric air, and that they constantly breathed from 25 to 90 thousandths of this gas. Air, found on analysis to contain three per cent. of sulphureted hydrogen, had been breathed for several minutes by the person collecting it. (*Annales d'Hygiène*, vol. ii. p. 144.) [The recent observations of the various sanitary commissioners of England, go to prove that an exceedingly small proportion of this gas will produce disease and death. Dr. Letherby (Report on Sewerage and Sewer Gases, p. 33,) states that the men engaged in cutting the Thames Tunnel suffered severely from the gas, though the proportion in the air was hardly to be discovered by lead-paper, and could not therefore have exceeded one part in 100,000. Dr. Letherby's report contains another, and even more remarkable case: In Clayton Moor, near Whitehaven, there is a row of small cottages built on the refuse slag from the iron furnaces. These are inhabited by the workmen, who had for some time been annoyed by a bad smell. Suddenly in June, 1857, the smell became unusually offensive, and in two days thirty of the inhabitants were made sick. In one of the houses a family of two adults and five children went to bed in usual health; before morning two were dead, and the others insensible; a third died during the day, and a fourth in a week. In a second case, a healthy man returning from his night work went to bed, in an hour he was found dead. An inquiry was instituted, and Dr. Taylor found that sulphureted hydrogen, generated by the action of water on the slag, was the cause of death. Here, too, the proportion could barely be detected by lead-paper.—C. R. G.]

and face being particularly affected." The abdomen is often tumid, and recovery is preceded by vomiting of a bloody froth. Severe colic pains are also common.

"In cases where an individual has been long exposed to the action of this gas, all power of motion and sensation is lost; a frothy saliva, tinged with blood, flows from the mouth; the lips and face are livid; the eyes are shut, and void of all brilliancy, the pupils fixed and dilated; the pulse small and frequent; the respiration short, difficult, and apparently convulsive; the action of the heart becomes disordered and violent; and the extremities are relaxed. To this succeeds an agitation more or less violent, with spasms and convulsions, and the body is curved backward, while the individual appears to suffer from acute pain."*

Delirium occasionally occurs, and in one instance mentioned by Dupuytren, the eyes were open and red. This, however, has been ascribed to the presence of hydrosulphuret of ammonia, which is frequently found with sulphureted hydrogen in sewers.†

In one fatal case, on dissection forty hours after death, the head and trunk were already putrid, the skin bluish and elevated by gas, the blood in the various cavities black and fluid. The brain was greenish and tender. The bronchiæ were of a red color, and the posterior parts of the lungs were gorged with black blood, but still crepitous. The stomach presented traces of recent irritation, and the intestinal canal was greenish. The liver, of a greenish-black color, was in a state of congestion. All the viscera exhaled the smell of putrid fish, and several of the persons present at the dissection were subsequently affected with lassitude and stupor, and violent colic.‡ Experiments on animals have presented similar results.§

* These quotations are from Orfila's Directions, p. 167. They are derived from Halle's Recherches, Paris, 1785. See also, a case by Dr. Howard, Boston Medical and Surgical Journal, vol. ii. p. 401.

† In the Dictionnaire des Sciences Médicales, vol. xliii. p. 305, art. *Plomb des Fosses*, the occurrence of ophthalmia and coryza is expressly ascribed to the hydrosulphuret of ammonia.

‡ New England Journal, vol. viii. p. 279. Account of three cases extracted from the Nouveau Journal de Médecine for April, 1818.

§ Orfila's Toxicology, vol. ii. p. 374.

Chlorine, or what is still better, the chloruret of soda, (liquid,) has been found by Dupuytren and Labarraque effectual in recovering some sufferers. A cloth dipped in it should be frequently held to the nose.* Cold affusion, removal to pure air, and the use of stimulants, are indispensable.

G. *Of persons found hung.*

I need hardly apprise the medical reader that there is an intimate resemblance between the principal physiological phenomena observed in persons *hung, strangled, and smothered*. I shall, therefore, in this section, consider these in detail, and hereafter confine myself to what may be deemed peculiar to the other kinds of death.

We understand by the term *hanging*, the suspension of a person by a cord or some other ligature around the neck. The rapidity of death evidently depends much on the manner in which the cord is adjusted, the texture and strength of the intervertebral ligaments, the fullness of the blood-vessels, and the strength of their coats, the weight of the body, and the height and suddenness of the fall.†

As to the cause of death there is considerable variety, depending on the circumstances above noted.

The first to be mentioned is congestive apoplexy, (not necessarily accompanied by rupture or extravasation,) produced

* Devergie, vol. ii. p. 518.

† Dr. Plott, in his History of Staffordshire, quotes a patent roll of the forty-eighth year of Henry III., in which it is stated that Inetta Balsham, having been convicted of harboring thieves, was sentenced to be hung, and accordingly was hung, but remained alive from nine until the next morning. A free pardon was therefore granted her. Dr. Plott suggests that her life was probably preserved on account of the larynx being turned to bone, "as it happened in the case of a Swiss, as I am told by the Rev. Obadiah Walker, Master of University College, who was attempted to be hanged no less than thirteen times, yet lived notwithstanding, by the benefit of his windpipe, that after his death was found to have turned to bone." (Professional Anecdotes, London, 1825, vol. iii. p. 180.)

"Governor Wall was long in dying, in consequence of which a particular examination of his throat took place, and it was found to have been owing to an ossified portion of the trachea resisting the rope." (Dr. A. T. Thompson's Lectures, London Medical and Surgical Journal, vol. vii. p. 418.)

by pressure on the large blood-vessels that go to the head. Though this has been occasionally doubted, yet it unquestionably does happen. The compression prevents the return of the blood by the veins, and although it cannot obstruct the circulation by the intervertebrals, yet it does cause an extreme congestion of the vascular system of the head, and of the brain particularly. It would not seem, however, in cases of recovery, to be attended with an ordinary consequence, viz., paralysis. Foderé has collected some curious cases in illustration of this. Thus, Wepfer saw both a man and woman who survived hanging. The latter recollected nothing, and the former stated that, on the application of the cord, he felt no pain, but sunk, as it were, into a profound sleep. Morgagni also mentions that an individual, who had recovered under similar circumstances, informed him that the first sensation was flashes of light before his eyes, and that he then sunk into the same sleep. Our author also quotes a case on the authority of Lord Chancellor Bacon. A gentleman took a fancy to ascertain whether those who were hung experienced any pain, and actually performed the experiment on himself. He immediately lost all consciousness, and the event would have been tragic, had not a friend entered in time to cut him down.*

In some fatal cases, as we shall presently show, the brain exhibits the ordinary appearances of apoplexy.

Another immediate cause of death, and about which there is hardly any dispute, is asphyxia. The following experiment by Dr. Munro, Sr., of Edinburgh, strikingly illustrates the correctness of this opinion: "A dog was suspended by the neck with a cord, an opening having been previously made in the trachea below the place where the cord was applied, so that air could pass into the lungs as freely as in ordinary respiration. After hanging in this state for three-quarters of an hour, during which time the circulation and breathing went on as usual, he was taken down, and appeared not to have suffered materially from the operation. The cord was then shifted from above to

* Foderé, vol. iii. p. 134. He, however, mentions that there were individuals living at Marseilles, who, during the French Revolution, were hung, and their lives saved in the night-time, and who for a long time were affected with a ringing of the ears and deafness.

below the opening made into the trachea, so as totally to prevent the ingress of air into the lungs, and the animal being again suspended, was in a few minutes completely dead.”*

[In Smith’s Forensic Medicine, p. 561, a very extraordinary case is given, which, if authentic, illustrates this point much more strikingly than Muuro’s experiments. A man was hanged at Tyburn, in April, 1733, whom a Mr. Chauvel undertook to save by making an incision in the trachea. This was done, and it was proved that the man could breathe through the opening. When hanged, it was observed that he was alive after the others were dead. He was cut down after being suspended three-quarters of an hour. On being taken to a house and bled, he opened his mouth and groaned, but no other signs of life were elicited. The failure was attributed to the great weight of the man. Many cases of failure in restoring animation, where the man has breathed after being cut down, are recorded. I have seen one where the body was suspended but a few minutes.—C. R. G.]

In connection with this, or possibly with both these causes of death, the injury produced by compression of the nerves of the neck, must not be overlooked. That it aids in producing death, is proved by the experiment of Mr. Brodie; he “passed a ligature under the trachea of a Guinea-pig, and tied it tight on the back of the neck with a knot; the animal was uneasy, but nevertheless breathed and moved about. At the end of fifteen minutes the ligature was removed; on the following morning, however, it was found dead.”†

Though apoplexy or asphyxia may cause death, yet in many instances they unite in producing the fatal termination.‡

* From Curry, quoted by Dr. Roget, art. *Asphyxia*, in *Cyclopedia of Practical Medicine*.

† Paris, vol. ii. p. 44.

‡ I refer particularly to two very valuable dissertations in the *Annales d’Hygiène*, both translated from Henke’s *Zeitschrift*: one, by Prof. Remer, of Breslau, entitled *Materials for a medico-legal examination of death by strangulation*, vol. iv. p. 166; and the other, by Dr. Fleischmann, of Erlangen, on the various kinds of death in strangulation, vol. viii. p. 412. I shall have frequent occasion to refer to these, and I may here also apprise the reader of an analysis of a most valuable essay by Casper at the conclusion of the present section.

Taylor (Med. Jur., p. 487,) gives the following table as illustrating the proportion of deaths, in cases of hanging, from each of these causes. The cases are from Remer (Ann. d'Hygiène, vol. iv. p. 166,) and Casper:—

Apoplexy	18
Asphyxia	20
Mixed cases.....	130
	<hr/>
	168

To these a third is to be added, consisting in a luxation or fracture of the cervical vertebræ, from a rupture of the ligaments of the neck. The celebrated Louis inquired of several executioners how they saved the lives of some criminals, while others were irrecoverably dead? It was answered, that in the latter case they caused a laceration of the trachea, and a luxation of the first cervical vertebra from the second, by placing the knot of the cord under the neck, and then giving a rotary motion to the body at the moment when the ladder was taken from under its feet.* This luxation chiefly occurs in heavy persons, or where they have fallen from a height, or where attempts have been made to hasten death by increasing the weight of the body. The rapidity of the result is well illustrated by accidents where the vertebræ are injured.

The above statement evidently explains the great diversity in the phenomena, observed of late years, on the bodies of those who die from hanging. This subject, indeed, has attracted peculiar attention, and all variations from received accounts have been carefully noticed.

I will first mention such as have been generally deemed signs of strangulation. The mark of the cord around the neck, forming a livid, depressed circle; the face, chest, shoulders, and occasionally the arms and hands, swollen and livid; the countenance distorted; the eyes open, red, or protruded; the tongue sometimes wounded by the convulsive motions of the jaws, or thrust out of the mouth, the fingers bent, and the hands nearly closed. De Haen added, that a bloody mucus often issues from the mouth and nose.† In some instances

* Foderé, vol. iii. p. 141.

† De Haen, vol. iv. p. 338. In the case of Scott, the American diver,
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ecchymosis is distinctly seen on the shoulders, and extending upon the breast.

Of late years, there have been added to the external signs, the semi-erect condition of the penis, and the emission of semen. The fæces and urine are also sometimes expelled at the moment of death. It is further stated, that in females, a bloody discharge from the uterine organs has been noticed.

All, or most of these are sometimes not found, and unless we can refer these diversities to different modes of death, the subject must remain extremely intricate.

The mark of the cord around the neck has generally been deemed a common occurrence in death by strangulation, and hence its presence was greatly relied upon. It was known, indeed, and is so stated by De Haen and Foderé, to have been sometimes wanting. This, however, was thought to be a very rare occurrence, was not much discussed, and was explained, when noticed, from the suddenness of death in these instances. The following case by Esquirol attracted marked attention to its presence or absence: An insane female at the Salpêtrière was seen to hang herself on a tree in the garden. An attendant immediately hastened to cut down the body, but all attempts to restore life proved fruitless. The features were composed and natural; the skin not discolored or ecchymosed. There was a double mark on the neck, as the rope had been twisted twice around it, but there was only a simple depression, without any change of color. In three hours after there was no change; in seven hours, the mark of the rope had a light-brown tinge, but without any ecchymosis. None, indeed, occurred; and on dissection, the cellular tissue beneath was

who hung himself *accidentally* in London, in consequence of using a slip knot to suspend himself instead of a bowling one, the body was examined twenty four hours after death. There was a mark on the skin around the neck, but it was quite superficial and did not extend to the cellular membrane. There was scarcely any mark over the larynx; it passed up anterior to the ears. The brain presented nothing unusual, except that it was somewhat congested at its posterior part; the spine was healthy and sound; the lungs were very much congested, and the heart and large vessels were full of fluid blood; the lining membrane of the air-passages was particularly congested. (Lancet, No. 909.) Here the body was probably immediately taken down. [It hung thirteen minutes before any alarm was excited.—C. R. G.]

found dry and compressed, so as to form a *brilliant white band a line and a half in breadth*.*

Since the publication of this case, the absence of ecchymosis has been noticed by others. Dr. Klein, a German, in fifteen cases of suicide by hanging, could not find it.†

Dr. Remer examined no less than 102 medico-legal reports of persons dead by hanging, occurring in Silesia. Of these, 89 presented a distinct and well-marked ecchymosis; in one the skin was shrunk, and resembled parchment; in two others the skin was excoriated; in one putrefaction had advanced too far to permit an examination; and in nine it is expressly stated that the bruised condition was wanting. He also adds, that the ecchymosis was not confined to those who were suspended from some height, but equally occurred in those whose knees or feet were in contact with the ground.

After recognizing these facts, he next inquires whether a satisfactory explanation can be given why this mark is present on the neck in some cases, and not in others? It has been suggested that its absence may be owing to the comparative softness of the article used for hanging. But even a handkerchief and a cravat cannot, in the ordinary sense, be deemed such, since they are twisted and folded so as to become hard, or at least take that character, by the pressure of the body. In four cases where handkerchiefs were used, there was ecchymosis; in two others there was none.

We come, then, with a greater probability of a solution, to the respective causes of death. Persons may die so soon from apoplexy, that no time is left for the cord to act on the living neck: for it must be kept in mind that *ecchymosis only happens when a sufficient interval has elapsed previous to death for the cord to produce its effect*.‡ To explain more fully the occasional

* Edinburgh Medical and Surgical Journal, vol. xix. p. 487.

† Annales d'Hygiène vol. iv. p. 168. Orfila, Leçons, second edition, vol. ii. p. 363, etc., mentions many other cases. See also, a very recent case of suicide communicated by Dr. Albin Grass. (Annales d'Hygiène, vol. xiii. p. 208.) In twelve cases examined by Esquirol, and twenty-five by Devergie, ecchymosis was also wanting. Also, in four by Fleischmann.

‡ It is due to the editors of the Edinburgh Medical and Surgical Journal to state that they indicated some years since the important distinction now

extreme suddenness of death in these cases, Dr. Remer conjectures that the pressure on the nerves, in conjunction with the congestion, may produce a state identical with a *palsy of the brain*. Out of thirteen cases, in which the absence of ecchymosis is particularly noticed, Dr. Remer found that in one the examination was so imperfect as not to permit any deduction; one exhibited, on dissection, the marks of death by suffocation, and the remaining eleven those of apoplexy, either simple or complicated, with suffocation.*

The deductions drawn by him from this investigation are the following: 1. The presence of ecchymosis on the neck is to be deemed a proof of death by hanging. 2. As it occasionally is wanting, its absence cannot be considered a positive proof of the contrary supposition. 3. When it is thus wanting, death has probably been sudden, and caused by apoplexy.

But we must also observe that the ecchymosed line, indicating the position of the cord, is not uniform in every individual. Out of 143, in whom the diversity was reported, it was found in 117 between the larynx and the chin, in 23 on the larynx, (one of these, indeed, had this organ torn,) and in 3 below it. Dr. Fleischmann notices a similar diversity, and endeavors to explain the various kinds of death in connection with it. When the cord, he observes, is so placed around the neck as to compress its large vessels, and particularly the veins, and at the same time prevent the passage of the blood below the constriction, apoplexy will follow, and in such instances the *face, neck, and brain will be the seat of ecchymosis or sanguineous congestion*. When, on the contrary, the cord is placed between the

developed by the investigations of Remer. In proof of this I offer the following extract. After stating that the period during which the rope has been left around the neck is insufficient of itself to explain the presence or absence of ecchymosis, they remark: "We believe the true cause may be shown to be rather the *more or less complete exclusion of air*. When the exclusion is complete and sudden, the body will present no unusual appearances; but when it is incomplete and gradual, so that the person lives for some time in a state of agony, the signs of venous turgescence are everywhere remarkable." (Vol. xix. p. 621.)

* Dr. Fleischmann is altogether opposed to the idea of a cerebral palsy, and prefers ascribing death in part to compression on the large nerves, which induces paralysis of the lungs and heart.

larynx and os hyoides, pressure operates powerfully on the respiratory passages, without so strikingly affecting the blood-vessels. Here death ensues from suffocation. The mixed cases, where death results from a combination of suffocation and apoplexy, occur when the cord is placed below the larynx. Its direction must necessarily then be horizontal, and it will interrupt the passage of the air, as well as compress the blood-vessels.*

These views of Drs. Remer and Fleischmann require confirmation, but they also deserve every attention as most valuable aids to a clear understanding of the subject.†

In some instances, according to Devergie, when the body is immediately cut down, the skin of the furrow made by the cord is perfectly natural, but its lips, both above and below, from one to two lines in breadth, are injected, and of a violet color. This is most distinct where the furrow is deep on the front part of the neck.

Occasionally there are slight excoriations of the skin in the furrow. If these have been inflicted on the living subject, they will be injected and bloody, and even if the excoriation has dried up, a portion of the skin placed before the light will exhibit its vascularity.

In every case, whether ecchymosis be present or not, there should be a dissection of the neck, and the subcutaneous cellular tissue particularly examined. It presents two aspects, shining and silvery, or white, dry, and destitute of brilliancy. The former is probably owing to a quantity of fluid still remaining in the part, of which the latter is destitute.‡

* Deslandes has suggested the possible case of the cord slipping upward at the moment of suspension till it is stopped by the upper jaw, and thus closing completely the orifice of the larynx. Here life would be instantaneously extinct, and almost without a struggle. (Orfila, *Léçons*, second edition, vol. ii. p. 359.)

† Out of six cases related by Dr. Fleischmann, ecchymosis around the neck was present in two. In the remaining four it was absent: but the mark of the cord was of a yellow color, hard and rough, resembling, I presume, parchment, as in the instances already cited. In one instance noticed by Amusat, there was a circular depression three lines in breadth, indicating the pressure of the cord, and the skin of this was dried, thin, and as if burned.

‡ Devergie, vol. ii. pp. 393, 395. Mr. Watson corroborates the observations

Echymosis should not be confounded with the lividity observed on the dead. By noticing the extent and the place of the extravasation, (in front as well as behind,) all mistake may be avoided. [On this subject Casper's remarks are of great value: "I can state with certainty, as the result of a large number of observations that every possible variety of ligature may produce every kind of mark." In general, rough and hard substances leave a mark exhibiting here and there trifling excoriations and patches of mummified parchment-like skin, while the mark left by softer substances exhibits this appearance much more rarely, but *by no means never*. The breadth of the mark generally corresponds with the size of the rope, &c., but there are numerous exceptions to these rules."—C. R. G.]

The next most important external sign is the *condition of the genital organs*. That urine, fæces, and frequently semen, are expelled at the moment of strangulation, appears to have been long known. It is mentioned by Drs. Gordon Smith and Male. M. Guyon, surgeon-major at Martinique, was present at the execution of several negroes. Being habited in white dresses, any circumstance of this description could more readily be seen, and he observed erection of the penis in several at the moment of strangulation, and immediately thereafter several urinated freely. One hour after the execution, he found the penis in a state of semi-erection, and its canal filled with semen.* Of Dr. Remer's cases, twenty-two were females and eighty males. Of the latter, forty-five were not examined. In twenty, nothing was found, and in fifteen there was either an emission of semen, or a sanguineous congestion of the genitals. Other cases will be quoted below.†

of Devergie in one of the above points. "It is very remarkable," says he, "that a considerable degree of redness occurs both above and below the line of the rope-mark. These red lines are probably caused by a reaction in consequence of organic life continuing some time longer than animal life." (Watson on Homicide, p. 139.)

* Anderson's Journal, vol. i. p. 151.

† Emission of semen and erection were found in Amusat's case; vesiculæ seminales empty. (North American Medical and Surgical Journal, vol. vii. p. 205.) By Orfila, in a suicide, aged 62 years. (Leçons, second edition, vol. ii. p. 376.) In one case of Fleischmann, (Annales, vol. viii. p. 420.) In Irons, executed at London, in 1828. (Lancet, N. S., vol. ii. p. 124.)

On the other hand, Dr. Klein did not observe it in his fifteen cases. It is therefore evident, that although its presence is a presumptive proof that death has been caused by strangulation, yet its absence does not infer the contrary; besides, it has occurred from other modes of violent death. Although Dr. Klein did not observe it in any of his cases of death by hanging, yet in a suicide who mortally wounded himself by blowing out his brains, surviving twenty-four hours, the penis was found in a state of erection. In another case, at Breslau, where a gun-shot had torn the descending aorta and its accompanying vessels, there were decisive proofs of the emission of semen.*

Analogous phenomena are noticed in the female sex. In a female who suspended herself with a handkerchief, besides a marked ecchymosis of the neck, the genital organs were seen red, the labia swollen, and the mouth of the uterus a little open.† Dr. Otto seems also to have noticed some bloody discharges, but the particulars of this case I have not been able to obtain.‡ Mr. Charles Cook mentions two cases of executed females, in whom, he was informed, there were present bloody discharges; and he himself noticed them in three insane

On the other hand, in Moselman, executed at Lancaster, Pennsylvania, in 1839, there was an ejection of mucus from the urethra, but it contained no spermatozoa, neither was there any priapism. (*American Journal Med. Science*, vol. xxvi. pp. 17, 26.)

This sign is again noticed when the proofs of suspension during life are considered.

* In the case of a person beheaded, Valentin found semen, containing very active spermatozoa in great numbers, in the urethra. Vogt has observed them in five persons who had been beheaded. Bischoff has noted the same thing in one case. Vogt refers this to a sudden and violent contraction of all the muscles, those of the vesiculæ seminales among the rest, occurring at the moment of the division of the cord. (*London Med. Gazette*, vol. xx. p. 528.) Klein observed erection in a person killed by shooting. Schledel found spermatozoa in a youth who threw himself from a tower, falling on his head, and Mertzdorf in a suicide by Prussic acid. Orfila found that congestion of the genital organs could be produced in bodies hanged after death. In one case a man, aged 49, was hung five hours after death, and cut down in three and a half hours. The penis, before only slightly turgid, was now erect, and at the orifice of the urethra a drop of semen, containing living spermatozoa, was found.

† Remer, *Annales*, vol. iv. p. 177.

‡ *Medico-Chirurgical Review*, vol. xxv. p. 213.

women who hung themselves. In one of these, urine and fæces were also evacuated; and it is an interesting circumstance, that two of them had passed the usual period of child-bearing.*

As to the remaining external signs, I must content myself with a brief commentary.

The condition of the tongue, its protrusion, its swollen state, and its wounding by the teeth, must evidently vary with the position of the cord. It is therefore not to be always found. Dr. Gordon Smith indeed remarks, and he has been followed by other authors, that it is only produced when the rope presses upon the cricoid cartilage. Should it press above the thyroid gland, the tongue will be pushed back, owing to the compression of the os hyoides.† Devergie, however, from a comparison of cases, questions the general correctness of this statement, and is disposed to attribute the protrusion to nervous agency, without, however, denying that the position of the cord may have some influence.‡ We are thus evidently warranted in ascribing something to the manner of death, whether easy or convulsed. In the latter, its unnatural position is most common.§

It is evident that the extent of injury to the soft parts of the neck must depend somewhat on the height from which the body is projected; and accordingly, we more commonly find these extensive in such as have been executed. Dr. Houston, of Dublin, in four cases of this description, found "the cervi-

* *Lancet*, N. S., vol. viii. p. 751. See also, on this subject, *ibid.*, vol. viii. p. 808; vol. ix. pp. 49, 98, 161, 661.

† Smith, p. 217; Belloc, p. 170; *Annales d'Hygiène*, vol. xx. p. 471.

‡ "1. I have found," says he, "the tongue projected in a body which bore unequivocal signs of death by drowning, and upon which there was no impression of a cord. 2. I have met with two cases in which the tongue was projected, notwithstanding the cord was applied above the os hyoides. 3. I have produced the same effect in the dead body by fixing the cord in this situation." According to the table prepared by him of thirteen cases where the cord pressed between the os hyoides and the thyroid cartilage, in six the tongue was pushed against the teeth, in four it was natural, and in three only it was locked between the teeth. In three cases out of four, where the cord pressed on the larynx, the tongue was protruded, and in the remaining one, it was natural. (*Vol. ii. pp. 384, 385.*)

§ In one instance, Devergie found the tongue bent back on itself.

cal vertebræ uninjured, and also the spinal marrow and the brain: yet in both, the sterno-mastoid muscle on the right side (the opposite to that on which the knot of the rope was applied) was ecchymosed, contused, and broken; that of the left was only slightly bruised. The os hyoides and thyroid cartilage were completely severed from each other. The other hyoid muscles were so bruised and lacerated that only some stretched shreds of them remained to hold the parts together. The thyro-hyoid membrane was also torn across, and the epiglottis, pulled from its root at the back of the thyroid cartilage, had passed up with the os hyoides and tongue into the back of the mouth. The skin alone remained unbroken, and interposed between the rope and the cavity of the pharynx. This was the only region of the neck which gave evidence of much injury; the great vessels and nerves all escaped unhurt."*

The variety in the *color of the countenance* must have some connection with the immediate mode of death. When there is an imperfect interruption of respiration, so that the struggle is prolonged, we find the cheeks, lips, and eyes, swollen. The admission of even a small portion of air into the lungs permits the heart to continue its action, while at the same time the pressure of the rope obstructs the return of blood which accumulates in the face.† When death takes place from asphyxia caused by compression of the larynx or trachea, and without compressing the great blood-vessels of the neck, the face is pale, and there are few signs of cerebral congestion, death occurring suddenly from pure asphyxia.

* Quoted by Dr. Beatty. There is a similar case in *Lancet*, N. S., vol. ii. p. 124. Dr. Dunbar, *Balt. Med. and Surg. Journal*, vol. i. p. 245, found the neck of an executed criminal dislocated, the first and second vertebræ so far separated as to admit the end of the little finger. The face was tranquil.

† Roget, art. *Asphyxia*, in *Cyclopedia of Practical Medicine*. Dr. Fleischmann supposes that the livid color of the face only occurs when apoplexy operates slowly. Sometimes one side is more livid than the other, and Dr. Kelly ascribes this to the position of the cord. The executioner generally adjusts it on one side of the neck, and by the weight of the body, it slips upward on that side toward the mastoid process behind the ear, and there is consequently a space corresponding to the rising of the noose which is not embraced by the cord, and where the veins are subjected to little pressure. Here, of course, there will be less lividity.

This course of reasoning may explain the fact noticed both by Fleischmann and Esquirol, viz., that if the body be cut down immediately after death, the face will appear natural, but if this be delayed for some hours, the internal congestion produces lividity and tumefaction in the face and the parts above the cord.*

The paleness of the face is hence no proof that death has not occurred from hanging. We find also, in many cases of apoplexy, an absence of similar congestion.

The presence of bloody mucus, or froth issuing from the mouth or nose, is not by any means constant. In some instances, as in that of the Duke of Bourbon, it is seen, while in many executed it is wanting.†

The fingers are frequently found flexed, and sometimes the convulsive contraction has been so great that the nails have sunk into the flesh of the palm of the hand.

As to the appearances on dissection, they must of course vary with the cause of death, and they will be more or less distinct according as it is least complicated.

In those dead from apoplexy, the brain will be gorged with blood, its vessels distended, and there may be extravasation, while the right as well as left ventricle contains blood.

When an individual expires from asphyxia, cerebral congestion will be wanting, but the lungs will be engorged and filled with air.‡ The left side of the heart will be empty,

* Devergie, vol. ii. p. 383. This author cautions us against taking too much as our standard the appearances observed on the executed. In many instances the struggle, the mental sufferings, and the fall closely assimilate their condition to that of the person who has been murdered by hanging. There evidently must be, in most cases, some difference between these and such as have committed suicide.

† I copy the following from a newspaper, and cannot therefore vouch for its authenticity. It, however, teaches a useful lesson: A man in one of the Eastern States was convicted of murdering his wife by strangulation; a physician deposed that in all such cases the tongue protruded, and there was foaming at the mouth; on this a respite was given, until another medical man present at a recent execution, testified that neither of these had occurred in the latter instance.

‡ Mr. Taylor states that the distention of the lungs with air is far from being universally seen in death from hanging. In animals hung, he has frequently met with these organs in a collapsed state. "I have also," he adds,

while the right and its vessels contain more or less of fluid blood.

Of the cases examined by Remer, as above stated, sixty-eight appeared to have sunk from the mixed effects of both asphyxia and apoplexy. In some, the marks of both are completely developed, while in others one seems to predominate. Thus we find the blood accumulated in the brain, and occasionally even extravasated, while the lungs also are gorged, and the right ventricle filled and the left empty. Here impeded respiration has interrupted the return of blood to the heart, and its congestion on the brain continues until the last pulsation, and it is this last pulsation which empties the left side of the heart.

Again, there may be an incomplete apoplexy; or, in other words, only a certain degree of congestion, with asphyxia. Dr. Remer, however, noticed but one of this description. Of the next variety he mentions thirteen cases, and this is complete apoplexy with incomplete asphyxia. The lungs contain air and blood, but the head dies first, and its effects extend downward. Here the death is so rapid that the blood continues fluid.*

"observed this in an executed criminal and in a case of suicidal hanging." (Med. Jurisprudence, p. 167.)

* As the appearances noticed in the text may seem somewhat arbitrary in their division and their peculiarities, I have subjoined such cases as I have been enabled to collect for the purpose of comparison. In Guyon's, (already referred to,) the blood-vessels of the head contained but little more than usual; those of the lungs were gorged, the right auricle also empty; the cervical vertebræ uninjured. In Mary Caen, executed at London in 1826, the rope had caught between the thyroid and cricoid cartilages and separated them; death occurred instantly; appearance natural; no congestion in the external veins of the head, and those of the dura mater but slightly distended; some effusion in the ventricles, and the blood altogether fluid. (Lancet, vol. ix. p. 688.) In Amusat's case, suicide by suspension, and where the most remarkable circumstance noticed was that the epiglottis was thrown back, and, as it were, turned on itself, congestion is not mentioned, but a serous effusion; the bronchiæ were gorged; the lungs also, and the right auricle, contained only a small quantity of fluid blood mixed with air. (North American Medical and Surgical Journal, vol. vii. p. 205.) In Esther Hubner, executed at London in 1829, there was congestion of the vessels of the dura mater and bloody serum oozing from some of the torn vessels of the bone itself; the longitudinal sinus was almost empty, but the other sinuses and the

Besides the appearances described in the preceding pages, there are some others occasionally observed, which deserve a brief notice.

In the case, of Dr. Amusat, already referred to, and which was suicide by suspension, at the point corresponding to the stricture around the neck, the middle and internal coats of the carotid were found ruptured, precisely as when a ligature has been applied to it. Devergie supposing, and correctly, that this, if constant, would be a valuable proof of suspension during life, made several dissections to ascertain whether it was always present; but out of thirteen he only noticed it in one. It was accompanied with a bloody infiltration into the cellular coat of the artery, but without ecchymosis in any of the adjacent parts. The cord consists of two pack-threads knotted together, and the neck was compressed circularly.

Dr. Devergie requested Dr. Lenoir of the Salpêtrière, to suspend dead bodies with the finest possible materials, and he accordingly did so in twelve cases; but although they were in several cases hung as soon as possible after death, and the legs pulled with some force, no lesion of the arteries could be discovered.*

In a case of suicidal suspension, along with the usual cerebral congestions, Dr. Prus found the upper and middle lobes of the right lung affected with vesicular emphysema; and at one part the air had escaped from some ruptured cells under the pulmonary tissue, and formed three bladders of air, each nearly an inch across.†

veins of the plexus choroides were full, but the arteries empty; the substance of the brain exhibited numerous bloody points; considerable effusion between the arachnoid and pia mater and in the ventricles. (Dr. Bright, *Medico-Chirurgical Review*, vol. xx. p. 3.) A case of suicidal suspension at the Salpêtrière, in December, 1834: the individual, a female, hung an hour and a half; face pale; the furrow which was in front of the os hyoides, was yellowish, like parchment; *the skin strongly adhering to the subcutaneous tissue*, but no ecchymosis; the substance of the cerebrum injected and the brain firm; very little blood in the lungs, and more in the left cavities of the heart than in the right. (By Dr. Gras, *Boston Med. Magazine*, vol. iii. p. 817, from *London Medical Gazette*.)

* *Annales d'Hygiène*, vol. ii. p. 196.

† *Medico-Chirurgical Review*, vol. xxii. p. 516. In all cases of persons hung, it is important to remember that the engorgement, if present, will be

Flaccidity of these organs has also been observed. In two cases of Dr. Fleischmann, this was seen very strikingly; and it is noticed by Dr. Rhineland, in his account of the dissection of Le Blanc, executed in New Jersey in 1833. The face was livid; the mark of the rope was below the cartilages of the larynx, and very deep; the superficial veins were greatly distended with dark fluid blood; while the carotids and internal jugulars were empty; the lungs collapsed, and the right auricle and ventricle empty.

Dr. Fleischmann explains this occasional collapse by supposing that death occurs at the moment of making a powerful expiration.*

The same variety that occurred between the condition of the internal and external vessels of the head in Dr. Rhineland's case, was much insisted upon by the late Dr. Kellie, of Leith. In his elaborate paper on congestions of the brain,† he even doubts whether the apoplectic state occurs in these cases, and mentions three examinations of persons executed, where the veins external to the cranium were fully distended, while but little change was seen internally. He mentions, also, that Dr. Munro had repeatedly observed a peculiar softness in the brain of persons executed.

Dr. Watson, in his lectures on the Practice of Physic, observes: I can corroborate the accuracy of Dr. Kellie's observations in these last instances, by what I have noticed myself. I paid particular attention to the condition of the head, when the body of Bishop, who murdered the Italian boy, was examined. When he was brought here after the execution, the eyes were blood-shot, and the lips and countenance turgid and livid. The inner surface of the scalp, when it was turned back, and the exposed surface of the skull were very red and bloody, and in

greatest at the depending part, at their base and diaphragmatic face, according to Rehard. This, however, should be noticed very early, since, if the blood continue fluid, a very short continuance of the body in the horizontal posture, will induce the usual appearance.

* Dr. John Davy states that in his experiments on animals strangled by a ligature on the trachea, but a very small quantity of air was found in the lungs. (Edinburgh Medico-Chirurgical Transactions, vol. iii. p. 444.)

† Ibid., vol. i. p. 131.

one part, on the right side of the head, there was some blood *extravasated*; but when the bone had been sawn through, and the skull-cap removed, the large veins of the brain did not appear unnaturally full.

In the year 1826, I was present at St. Bartholomew's Hospital, at the opening of the head of a woman who had been hanged the day before, for murder. I find the following statement in a note which I made at the time: "The scalp was bloody, but the brain was of a very natural texture and appearance, and not more than usually full of blood."*

The base of the tongue is usually of a high red color, and

* London Medical Gazette, vol. xxvii. p. 742. Dr. Burrows (Lumleian Lectures, No. 1,) has, however, brought together a variety of cases illustrative of the diversity of appearances of the blood-vessels of the head. In several, there was only congestion of the external vessels; in others, the internal ones were gorged. (Ibid., vol. xxxii. p. 150.)

The same author, in his work on "Disorders of the Cerebral Circulation," points out various circumstances influencing these phenomena:—

"When criminals are hung by the executioner, the knot of the rope is usually adjusted on one side of the neck; and it is found, after death, beneath the ear, resting on the mastoid process. It has been often observed, in the dissection of such criminals, that the cheek and integuments on this same side of the head are not near so livid and congested as on the other side. The pressure of the rope has not completely obstructed the return of blood through the external jugular vein on the one side, although it has effectually stopped the current on the other. In such cases it is probable that the deep-seated internal jugular vein on the one side has only been partially compressed, and has permitted, to a certain extent, the return of blood from the internal parts of the cranium.

"But there is another still more efficient cause of this occasional absence of congestion of the cerebral vessels after death by hanging; it is the subsidence of the *fluid* blood after death while the body is yet suspended, through the cervical vessels, which are not completely obliterated by the pressure of the cord. And it should be recollected that there are some channels which are scarcely, if at all, affected by the compression of the rope. These other channels are the vertebral sinuses and spinal plexus of veins so ably delineated by M. Breschet."

The sinuses of the cranium may also be drained otherwise than through the vertebral sinuses. In examining the bodies of those who have died by strangulation, the great vessels of the neck are usually cut across to get at the thoracic viscera, and then when the head is elevated, to open the skull, the blood gravitates and flows from the cut ends, and the blood-vessels, previously congested, are rendered comparatively empty. (British and Foreign Medical Review, vol. xxii. p. 412.)

this frequently extends to the mucous membrane of the larynx and trachea, and sometimes even to that of the bronchiæ. Froth in the trachea is a very rare occurrence.*

In every suspected case, two questions may present themselves for solution by the medical witness.

1. *Was the individual suspended before or after death?* or, in other words, has he been previously killed in some other way, and then placed in this situation to avoid suspicion?

The materials for a proper answer to this are to be drawn

* Devergie, vol. ii. p. 404. I insert at this place the interesting observations of Dr. Flint, of Boston, made on five persons (pirates) hung at the same time (in 1835) in that city. The cord used was nearly three-fourths of an inch in diameter, and they fell four feet and a half.

In Nos. 1, 2, and 3, the knot was placed just below the occiput. In 4 and 5 it was drawn as usual to the mastoid process. Nos. 1 and 2 died almost instantly, with a slight shudder. No. 3, with rather more marked convulsive motions. Urine was passed about four minutes after the fall of each of these, and in one of them the fæces. In No. 5 the struggles were severe, and continued for five minutes.

The bodies were examined four hours afterwards. The limbs were somewhat rigid, and the fingers flexed and bluish. The cord in every instance was found above the thyroid cartilage, where it was imbedded in the integuments, but in none was there any ecchymosis. The face was neither swollen nor distorted, except in No. 5. The mouth and eyes were closed; there was no protrusion of the tongue nor frothing at the mouth. The corneæ were clear and the pupils slightly dilated, except in No. 5. Here they were somewhat contracted, and the conjunctiva suffused.

No. 4 had attempted to kill himself just before the time of execution, and, besides dividing the external jugular, a branch of the superior thyroid artery, and most of the fibres of the mastoid muscles, he had opened the trachea in two places. The wound was dressed and the marshal was advised to place the noose on the bandage, so as to compress the tube at its division. He was in a state of syncope when the drop fell, and died speedily. In the convulsive efforts at respiration after the fall, the air was heard at the distance of several feet rushing through the wound in the trachea.

Dissection was only permitted in this case. The lungs were perfectly healthy, except being distended with slight interlobular emphysema. The heart was rather empty; there was a little fluid in the right ventricle, and a small coagulum in the left. There was no congestion or extravasation in the brain. The cervical vertebrae were not dislocated nor their ligaments ruptured.

Dr. Flint considers Nos. 1, 2, and 3, to have been genuine cases of death by asphyxia, while No. 5 died apoplectic. He also remarks, that besides the above cases, he has observed in several others, some of whom were suicides, that the countenance was composed and exhibited no marks of distortion. (Boston Medical Magazine, vol. iii. p. 738.)

from a careful examination of the facts stated in this section. It is clear that so far from the marks being uniform, great diversity exists, originating unquestionably from the various ways in which death may be caused. We find, however, that in a majority of cases certain signs are quite constant, and if one or more of these be absent, we should ascertain, if possible, whether this is not owing to some peculiarity as already noticed.

An ecchymosis along the mark of the cord is allowed, even by those who question its frequency, to be a very decided proof of suspension during life; but if it be absent the difficulty of solution will be increased. I make this remark because Orfila unequivocally states that in twelve experiments on the dead body, some immediately after death, others after six, eight, or eighteen hours, the depression made by the cord and the skin under it, as well as the subcutaneous cellular tissue, presented precisely the same appearances as they do from suspension before death.*

Devergie also produced the parchment-like appearance of the skin and subcutaneous cellular tissue on the dead body. He considers it as purely a physical process of desiccation; the fluids being driven out by pressure, the laminae of the dermis being brought closer together, and a rapid evaporation of the remaining moisture being favored by exposure to the air. In this process, the violet color of the lips of the furrow already noticed, and caused by the blood being driven into them from the part under pressure, may also be produced on the dead body soon after death. On the living one, however, owing to

* *Leçons*, second edition, vol. ii. p. 381. Marc, however, doubts whether this state can be exactly produced on the dead body. (*Annales d'Hygiène*, vol. v. p. 178.)

Orfila is so positive, that he considers the presence of ecchymosis as very uncommon, and imagines that the brown color of the furrow has been mistaken for it. Devergie agrees with this, and altogether distrusts the statement of Remer, that so many cases (89) exhibited a well-marked ecchymosis. These cases, he remarks, were only reported to Dr. Remer, and the term *ecchymosis* is well known to be used in a loose manner by many observers.

It cannot, says Orfila, be *true ecchymosis*, as we scarcely ever find a single drop of blood extravasated in the subcutaneous cellular tissue corresponding to the cord. (*Leçons*, third edition, vol. ii. p. 440.)

the usual cerebral congestion, the upper lip will be deeper colored, and broader than the lower.*

We cannot, however, do wrong in particularly examining the form and situation of the mark around the neck, and pursue its dissection carefully. If it is at the bottom of the neck, unless the position of the body favor this, there is a probability of strangulation, since, if suspended, the cord would slip to the upper part of the neck. It may happen that a person has been strangled and then suspended. In this case we should expect to find two distinct circles on the neck, each characterized by its peculiarities.†

The congestion of the venous system; the excited state of the seminal organs, and the livid countenance, etc., all favor the idea of suspension during life; but we must not forget that other modes of violent death may produce them. Let the probability of these last be satisfactorily disproved, and the proof gains weight.‡

The presence or absence of luxation, or fracture of the vertebræ, is not to be greatly relied upon, as it may have been produced by force subsequently applied, such as pulling at the feet. The inference (if any) is, however, in favor of its being caused during life, if accompanied with the usual lesions.§

* Devergie, vol. ii. p. 394. It is doubted whether exposure to the air is absolutely necessary to produce the desiccation in question. "We have found the skin in a semi-corneous state even an hour after death, and when the cord had not been removed." (British and Foreign Med. Review, vol. ii. p. 420.)

† The existence of two impressions on the neck is, however, only strongly *presumptive*, not positive proof of murder. Esquirol reports the case of a female lunatic who hung herself, and on whose neck two distinct impressions were seen, one circular and the other oblique. The cord had been twice passed around the neck, while the body was at the same time partially supported. (Taylor's Med. Jurisp., p. 177.)

‡ An opportunity is also offered in cases that may hereafter occur of verifying the opinions of the German writers that I have quoted. If the signs, both external and internal, correspond with the apparent cause of death and the position of the cord, the inference must be strong in favor of suspension during life.

§ Orfila, Leçons, second edition, vol. ii. p. 388. It is proper to state that this author doubts whether, in the present state of our knowledge, we can go *beyond probability* in answering this question of suspension before or after death. If so, moral circumstances deserve a more careful investigation than ever.

Devergie, after reviewing the signs which we have enumerated, is disposed to place the greatest reliance on the following circumstances, as proof that the suspension or strangulation has occurred during life: The violet color of the lips of the furrow, and particularly the lower one. This is of some value, as he could only produce it on the dead body within a very few hours after death. Bloody excoriations of the skin, and *ecchymosis in the subcutaneous cellular tissue and muscles*. These carry with them the idea of life, and cannot be caused on the dead body; section of the carotid artery, the presence of semen, and fracture of the os hyoides, or rupture of the larynx or vertebræ. Unfortunately some of these are quite uncommon, and several have occurred from other modes of violent death.

In a still more recent memoir, Devergie recommends a careful examination of the fluid contained in the urethral canal, with the microscope. He prefers that it be pressed out, but if this will not answer, let the canal be divided longitudinally. The fluid, collected in either way, must be placed between two pieces of glass and carefully inspected. In several instances, he ascertained the presence of *spermatic animalcules*, and he relies much on this as a proof that the *hanging occurred during life*, particularly if it be accompanied with a *congestion of the genital organs*, not merely the penis alone, but also the corpora cavernosa, testicles, and vesiculæ seminales. In some instances, indeed, as in persons advanced in years, the latter may be present when the former will be wanting.*

Orfila, however, decidedly denies the value of this as a sign of suspension during life, as he had found the animalcules in the urethra of several persons dead from ordinary diseases, who remained lying on their backs; and again, the congestion

* Annales d'Hygiène, vol. xxi. p. 168. The corpora cavernosa, in one instance, were greatly congested, and contained extravasated blood in their cells.

I may add, that in some instances Devergie noticed, instead of the spermatic animalcules, a quantity of small ovoid bodies resembling them, but destitute of the tail, and as similar ones were observed in the vesiculæ seminales and also in two individuals who had never had any children, he is induced to suspect that they may be the cause of the unfruitfulness. [These were no doubt the formative vesicles of Wagner.—C. R. G.]

to a considerable extent (erection in one instance) occurred in bodies suspended after death.* Dr. John Davy confirms this.

Particular attention must be paid to dissection of the neck, and I therefore subjoin the directions of Devergie. Make two incisions, an inch above and an inch below the furrow, carry these sufficiently back, then unite them by perpendicular cuts and dissect the skin carefully from behind forward; then detach the cellular tissue separately, so as to ascertain its peculiar appearance. Watch closely whether any ecchymosis be present in either. Then remove each muscle in order and mark its condition. Lastly, remove the carotid artery and open it throughout its extent. The condition of the vertebræ, larynx, and the internal organs of the chest, must also be ascertained, as in all other medico-legal dissections.†

Wounds, effused blood, and marks of violence, are to be judged of according to the rules already laid down.

One or two cases will serve to illustrate the present question:—

A female aged fifty, at Mantes, (in 1683) was found suspended from a beam in a barn. The face was not discolored, no froth issued from the mouth or nose, the tongue was natural, there was no change of color around the shoulders, nor was the neck marked by the cord. It was determined to examine the body minutely, and a short investigation discovered a small wound, directly under the right breast, which, on being pursued, was found to have penetrated through the heart, and produced an

* Orfila further asserts that semen remains in the urethra of those who have had an emission until they pass urine, and consequently that it may be found there eight or ten hours after. Hence, in a case of natural death, or of death by poison, where the emission of urine had not yet taken place, this sign might be present. The controversy on this subject between the respective authors will be found in the *Annales d'Hygiène*, vol. xxi. pp. 466, 473; vol. xxii. p. 395. To the above objection, Desportes replies, that Devergie seemed to have in some measure guarded against this objection by requiring that congestion of the corpora cavernosa, and particularly of the glans, must accompany the presence of the zoosperma. Let *both* be absent, and the presumption is in favor of suspension after death. (*Bulletin de l'Acad. Roy. de Médecine*, vol. ii. p. 266.)

† Devergie, vol. i. p. 278; vol. ii. p. 402.

effusion of blood in the thorax. It was evident that she had been murdered.*

In 1811, a female in France, aged sixty, large and fat, was found suspended by a handkerchief from a tree in the garden. The height of the branch from which she hung was eight feet seven inches, and its distance from the trunk three feet six inches. The tree did not give off branches until at six feet from the ground.

Near the tree was a common ladder seven feet long, and on applying it for the purpose of mounting, it was found impracticable to reach the point of suspension. The bark was slightly rubbed above, but below was untouched and covered with moss. The heels of the body were two feet six inches from the ground.

The head bent a little forward and the hands were half closed. The face was pale and not tumefied, the eyelids natural and partly open, the eyes sunken and dull, the lips dry and not swollen, the jaws closed and the tongue approaching them. There was no froth in the mouth or nose.

On the neck where the handkerchief had been, there was a semicircular depression of a little more than an inch in breadth, extending upward. The color of this was a light violet. On the lower part of the neck, near the left clavicle, was a slight excoriation. The other external parts were natural.

On dissection, a tumor of the scalp was found in the occipital region, and when this was cut into, a fracture of the bone was seen, two inches long, accompanied with extravasation of blood. The lungs were soft, slightly engorged on their posterior part, and the right cavities of the heart were filled with fluid black blood.

The neck presented no ecchymosis or engorgement in the tissue under the parts where the handkerchief had been placed. The tissue under the excoriation just below was, however, ecchymosed.

The medical testimony in this case was, that death had not resulted from suicide, nor indeed from hanging; but that the injuries stated preceded the suspension.†

* Deveauz, quoted by Foderé, vol. iii. p. 153.

† Chaussier, Recueil, p. 376.

2. The second question is, *whether the individual has hung himself, or has been hung by others?*

The presumption in all cases of suspension is favorable to the idea of suicide, since hanging is a difficult mode of perpetrating murder, unless the strength of the parties be greatly disproportionate, or the assailants be numerous and powerful. Accordingly we find that in a vast majority of cases it is an act of suicide. It must, however, be understood that there are instances in which a decision is very difficult, as the marks left either from homicide or suicide may be precisely similar.

We should first ascertain whether suspension took place before or after death; and next, the immediate cause of death, as before stated. The instrument of death, that is, the cord, should be compared with the furrow that it has made, so as to ascertain whether the diameter of the neck be much diminished by it. All the circumstances which indicate strangulation are so far against the idea of suicide.*

From an examination of fifty-two cases of suicide by suspension or strangulation, Devergie found that ecchymosis was noticed in three only, and in a fourth there were some small erosions and blisters in the furrow. He therefore supposes that in suicidal hanging, ecchymosis is very rare. Whether its presence is presumptive proof in favor of violence, may, however, still admit of a doubt.

The presence of luxation or fracture of the vertebræ is an indication of homicide, and for the reason that we most frequently meet with them in persons executed, and then, as I have already stated, often in consequence of some additional

* Foderé observes that in suicide, that portion of the cord which surrounds the neck is relatively longer than in homicide, where the constriction will be more violent. The skin will also in this case be more drawn up toward the chin. (Vol. iii. p. 159.) Mahon remarks that in assassination, the neck is sometimes so compressed that the diameter of the circle described by the cord is not more than two or two and a half inches. He saw a female who had been hung, in whom the integuments alone resisted the cord; the vertebræ, muscles, and larynx were separated, and the diameter of the circle was about two inches. (Vol. iii. p. 49.) It is, however, doubted, and I think justly, by Male (p. 235) whether this should be considered a conclusive proof of homicide. Much of the tightness of the noose must depend on its situation.

force applied by the hangman.* But it may also happen, as suggested by Belloc, when a suicide precipitates himself from some height, or even when the body is heavy and has descended with some force against the cord. These are, however, exceptions, and their existence may be ascertained by proper examination. A case of this description occurred to Dr. Ansiaux, of Liege, in the person of a female who hung herself from a beam in the barn. She had mounted by a chair. On dissecting, the intervertebral ligaments between the first and second vertebræ were found ruptured.†

A case related by Mr. Campbell De Morgan is worthy of notice. A female, extremely weak, and laboring under an agonizing cancerous affection of the uterus, desired those about her to go into another room, as she felt disposed to sleep. She was seen shortly after in the same situation, but in about half an hour was found hanging from the bed-rail, about three inches from the ground. An old handkerchief had served as a cord; the front of the body was turned toward the bed, and the head thrown forcibly back, the knot being placed on the middle of the under side of the chin.

The face was pale, the eyes natural, the cord mark well defined and like parchment, and at the upper end of the groove, on the right side, was a thin line of congestion. The direction of the cord mark was, however, remarkable. It was very deep at the posterior part of the neck, just over the atlas, and extended in a direction from above *downward* and forward on each side, to the posterior edges of the sterno-mastoid muscles, a little below the angle of the jaw; anterior to this there was no mark whatever, excepting one broad, hard patch just under the chin, where the knot had made its impression.

There were thus no proofs that dyspnœa or cerebral congestion had been the cause of death. But it seemed probable that the spinal marrow was injured, and such was found to be

* As by leaping on the shoulders, practiced at the Cape of Good Hope, or pulling the legs. (Edinburgh Medical and Surgical Journal, vol. xxxix. p. 397.)

† Belloc, p. 173. Orfila, Leçons, second edition, vol. ii. p. 381. Remer is strongly in favor of luxation being considered a proof of murder. Orfila is at best doubtful and rather disinclined to rely much on it.

the fact. Ecchymosis was found about the deep muscles, over the second and third cervical vertebræ, and also, on removing the first five vertebræ and opening the canal, in the sheath of the spinal marrow, at a part corresponding to the external injuries. At the left side and exterior to the sheath, was an extensive effusion of blood, firmly coagulated. The odontoid process was firmly retained in its place, none of its ligaments having given way, nor were there any marks of fracture of the vertebræ, nor of laceration of their ligaments, but there was an unusual degree of mobility between the third and fourth vertebræ, as though the ligaments had been stretched.

Here, then, was an instance of a very feeble female, and in whom the fall must have been trifling. But the peculiar position and direction of the cord were such that the force must have operated in bending the head and the two upper vertebræ abruptly backward. And still there was no rupture of the ligaments and processes, but an *effusion of blood on the spinal marrow*, causing fatal compression.*

Wounds and marks of violence on the body are generally to be deemed proofs of homicide. But there may be suicides who injure themselves previous to suspension. De Haen records a case of a person who, while hanging, inflicted several wounds on his face. These, however, we should not consider as the cause of death. A still more remarkable case is mentioned by Ballard, of a young ecclesiastic who cut his throat partially and then hung himself in the vestments of his office, which he had arranged for this purpose.† Dr. Male has also suggested that wounds may possibly be accidental, as when a

* Lancet, August 10, 1844. The only instance, according to M. De Morgan, where death was supposed to have been caused by the forcible bending of the head backward, is mentioned by Devergie, (vol. ii. p. 477, second edition.) In this, however, the body was not opened, and both Esquirol and Devergie doubt the truth of the explanation offered of the cause of the absence of all external signs of death by dyspnœa, viz., the luxation of the cervical vertebræ. The present case, however, renders that explanation more probable. An additional weight of the body and a more considerable fall might have induced it. Still the injury may have been as in the present instance.

† Ballard, p. 409.

person by swinging himself with violence breaks the rope and wounds himself by falling upon some article of furniture. The following case occurred to him: "An apprentice boy in my neighborhood, working alone in an attic, tied one end of a rope loosely around his neck, while his master was from home, probably without any intention of destroying himself, and twisted the other round the projecting part of the top of the door, the planks of which were irregular and somewhat divided; a small stool on which he stood slipped from under him, when he fell forward, striking his temple against the corner of a box, which cut him to the bone. He lay along the floor, his head and shoulders only elevated a few inches above it. The cord not being tied, had nearly run its whole length, and then caught within the planks of the door, in which state he died. The wound was magnified by popular rumor into many, and vengeance was denounced against the innocent master, who was accused of having first killed and then suspended the boy. On examination, the mark of the cord was found to extend from ear to ear, the vessels of the brain were turgid, the thyroid cartilage broken, the nails blue, and the hands firmly closed. From this and other important circumstantial evidence, the coroner's jury were convinced that the charge was unfounded."*

The situation of surrounding objects, the state of the dress, the place and posture of the body, the appearances of the hands and nails, whether they bear any mark of resistance, all deserve attention.

George Hebner, a tailor, was found hanging to the top of a bedstead, in the garret of a house of ill-fame, in Dean Street, London, kept by a widow Hughes. His hands were tied behind his back, and his handkerchief drawn over his face. The rope around his neck was fastened by what is termed a sailor's

* Male, p. 182. A prisoner was found dead hanging in his cell, with his feet touching the floor. There were two slight wounds in the middle of the left parietal bones and others of a similar character on the right side. His handkerchief was stuffed into his mouth. There were no marks of resistance and violence, and the whole moral testimony was in favor of its being a case of suicide. By Dr. Heyfelder, from Henke. (*British and Foreign Medical Review*, vol. ix. p. 264.)

knot. These circumstances indicated homicide, and they led to the detection of a sailor, Ludman, who, with Mrs. Hughes, was found guilty and executed.*

The state of mind of the deceased, his previous history, and situation in life, all may aid us in forming an opinion, and particularly so if a predisposition to insanity is found to exist. We should not rely much on the cast of countenance. Although everything on it indicative of fright or horror is so far in favor of violence, yet we must remember that the suicide, at the moment of the mortal pang, may experience similar feelings.

A curious trial, for an attempt at homicide by hanging, occurred in 1827, in the Scottish courts. Marion Brown, a woman aged sixty-nine, twisted a small rope three times round the neck of her husband, older than herself, while he was asleep, and fastened it to a beam in the room in such a manner that, when the neighbors entered, he was found lying on the floor, with the head raised about a foot from it. He was quite insensible, his face livid, and it was some minutes before he could be roused. He deposed that *he was not aware of anything that passed during the attempt to hang him*. The prisoner was proved to have been intoxicated, and was only sentenced to imprisonment.†

"If the person be not elevated from the ground or floor at all, while the cord is not so tight about the neck as to strangle in this posture, and no other cause of death can be discovered, there can hardly be a possibility of doubt as to self-murder. A few years ago, a man, aged seventy-five, destroyed himself at Castle Cary, by fixing a cord round his neck while sitting on the bedside, leaning forward till his purpose was accomplished. His wife, who had for years been bedridden, and therefore not likely to have been fast asleep, was in the room during the transaction, and knew nothing of what was going on."‡

Among the multiplicity of cases that have come before legal tribunals, I will only select five for consideration.

A young man, eighteen years of age, and named *Bartholo-*

* Paris, vol. iii. p. 44.

† Syme's Justiciary Reports, p. 152.

‡ Smith, p. 278.

mew Pourpre, was found dead, and hanging to a tree, at seven o'clock in the evening of the 12th of August, 1736. A surgeon, who examined the body, certified that he had been strangled. His father had married a second wife, who was on very ill terms with the young man, and had produced frequent quarrels and threats of murder between them. Suspicion was therefore excited, but its probability was destroyed by the idea that a father would not murder his son, and also from the circumstance that he was fifty-two years old, and his son eighteen, and in full health and vigor. On this reasoning, the father was acquitted, and the son was deemed to have hung himself.

An order having, however, been made to prepare a statement of the suicide, and the case being carried up to the parliament at Aix, the attorney-general discovered such facts in the statement of the surgeon as led him to believe that *Pourpre* had not destroyed himself. It was mentioned not only by him, but by other witnesses, that the mark of the cord, instead of being at the upper part of the neck, was at its lower part, just above the shoulders; and secondly, that the teeth were knocked in, and bloody. On dissecting the integuments, no alteration or ecchymosis was found on the upper part of the neck, but under the skin, just above the clavicles, there was a circular and deep-seated ecchymosis, the muscles were livid, and the trachea was red, with some rupture of its fibrous fascia. The parliament, from these facts, decided that the father had strangled him, and had put his foot on the mouth of his son, either to prevent his cries or to hurry on the strangulation. The suspension, they declared, was subsequent to his death. Whether the father was guilty or not, we must at least say with *Foderé*, that two facts are well established in this case: 1. That the son had been strangled before being hung. 2. That the strangling had been done not by himself, but by others.*

Marc Antoine Calas was the son of John Calas, a merchant of Toulouse, aged seventy years, of great probity, and a Protestant. This son was twenty-eight years of age, of a robust habit, but melancholy turn of mind. He was a student of law,

* *Foderé*, vol. iii. p. 152, cited from *Louis*; *Chaussier*, p. 439.

and becoming irritated at the difficulties he experienced (in consequence of not being a Catholic) concerning his license, he resolved to hang himself. This he executed by fastening the cord to a billet of wood placed on the folding-doors which led from his father's shop to his store-room. Two hours after he was found lifeless. The parents unfortunately removed the cord from the body, and never exhibited it to show in what manner his death was accomplished. No examination was made. The people, stimulated by religious prejudice, carried the body to the town-house, where it was the next day examined by two medical men, who, without viewing the cord or the place where death had been consummated, declared that he had been strangled. On the strength of this, the father was condemned by the parliament of Toulouse, in 1761, to be broken on the wheel. He expired with protestations to heaven of his innocence.

Reflection, however, returned when it was too late. It was recollected that the son had been of a melancholy turn of mind; that no noise had been heard in the house while the deed was doing; that his clothes were not in the least ruffled; that a single mark only was found from the cord, and which indicated suicide; and, in addition to these, that the dress proper for the dead was found lying on the counter. Voltaire espoused the cause of the injured family, and attracted the eyes of all Europe to this judicial murder. The cause was carried up to the council of state, which, on the 19th of May, 1765, reversed the decree of parliament, and vindicated the memory of John Calas.*

The Duke of Bourbon, (otherwise called the Prince of Condé,) the father of the unfortunate Duke D'Enghein, was residing at the Chateau de St. Leu, in the seventy-fifth year of his age. On the evening of the 26th of August, 1830, although much depressed with the result of the "Events of the Three Days," he entertained a party, and went to bed at midnight, leaving directions that he should be called at 8 A. M. The key of the door of his apartment was, according to custom, in the hands

* Foderé, vol. iii. p. 167, from the *Causes Célèbres*. See also Grimm's Historical and Literary Memoirs, (from 1753 to 1769,) vol. ii. pp. 41, 117, and 160.

of *Sieur Le Comte*, who locked it, but the duke himself closed the inner bolts. At the appointed time the signal was made, but no answer being returned, it led to alarm, and finally to breaking open the door. On entering the room and opening the shutters, the duke was found dead, hanging from a curtain-rod attached to the top of the window. A chair was displaced on opening the shutters. The height of the rod from the floor was six and a half feet, and attached to it were two white linen pocket-handkerchiefs tied together. The noose formed by them suspended him. The tongue projected out of the mouth; the visage was pale; froth issued from the mouth and nose; the arms hung by his side, and were stiff; the fingers closed; the toes touched the floor, the left heel being elevated three inches, and the right, one and a half; the knees were half bent. His night-dress appeared natural and undisturbed, and the bed was as if a person had lain in it.

On further examination, no ecchymosis was seen around the neck, but a distinct depression, most marked on the left side, where the knot of the handkerchief had been situated; blood also flowed from the urethra.

These were the facts elicited in the inquests made by the physicians first summoned, and all within a few hours after death.

The circumstances, however, of this case, and the high rank of the individual, rendered a more extensive inquiry necessary; and accordingly a commission, consisting of Drs. *Marc*, *Marjolin*, and *Pasquier*, was appointed, and they acted on the 28th. The additional facts reported by them I will now state.

The face continued pale, and the back and the depending parts of the body were livid, as is usual in corpses; the depression made by the handkerchief was between the *os hyoides* and the upper third of the thyroid cartilage, passing upward and backward, and terminating at the mastoid process. The skin under it was dry, hard like parchment, and of a yellow color. There was a very slight excoriation, three lines in diameter, just below the furrow; also a slight ecchymosis about an inch below the posterior part of the elbow, and one or two excoriations on the front of the legs. All these last are ascribed to

contact with the chair and wainscoting, while in the act of stepping off.

On dissection, no ecchymosis was found in the parts under the furrow, but they were hardened and thickened; the external jugulars contained but little blood, the internal were very full of fluid black blood; the carotid had a little serous blood; there was no contusion or lesion on the external integuments of the head; the dura mater adhered, and its vessels were engorged; there was some serum in the ventricles, and the substance of the brain was soft. All the other parts of the head were healthy. The cartilages of the larynx were sound; the tongue swollen and livid; the mucous membrane of the bronchiæ injected and red, and a bloody froth in all their divisions: the lungs crepitant, dark colored, and filled with blood, while both sides of the heart were equally empty; semi-erection and an emission of semen.

Dr. Marc, from whose account I have taken the above facts, proceeds to consider the case under the two questions which I have previously noticed.

That the *hanging occurred during life*, is, in his opinion, established by the absence of any other lesion that will account for death; by the condition of the tongue, of the genital organs, of the blood-vessels; by the fluidity of the blood, the state of the bronchiæ, and the lungs and heart. Even the appearance of the furrow is no evidence against it, since that is known to be present in many instances.

But, secondly, *was this a case of suicide or homicide?* From the state of parties, this became a debated question; and indeed some physicians, as Dubois and Gendrin, gave it as their opinion that the duke might have been murdered. The position of the body touching the floor with its toes; the ecchymosis just *below* the mark of the cord; the assertion that from a previous injury to his right hand, his fingers were injured, while from a fracture of the collar-bone, the left arm was so weakened that he could not raise it above his head; the state of his mind on the evening of his death; all were urged in favor of the probability of violence. The excoriations on the arms and legs might be equally the act of the murderer dragging the body to the place of suspension.

To these presumptions Marc replies, that if murdered, the mark of the noose would have been more parallel with the lower jaw. It is hardly possible that assassins would have given it that direction on which they could apply least force. They would also select a cord or a rope in preference to a cravat or handkerchief, as producing the desired object much sooner. Besides, the mark did *not extend around the whole neck*. All these are difficulties, even supposing the prince was asleep when strangled; but if awake, there must have been more striking marks of resistance. That on the neck was evidently caused by the cord, and on the other parts, by striking against the chair or window. They were oblong in form, and in each case on the front side. As to the state of the shoulder from fracture of the collar-bone, Dr. Marc remarks that nothing was discovered to warrant this assertion. On the contrary, it was notorious that the duke was an accomplished sportsman.

That the position of the body is not inconsistent with the idea of voluntary suspension, is incontestably proved by several cases, either seen by himself, or derived from other observers. In one, a man was found suspended to a cross rope going between two beams, by means of a cotton handkerchief. This was in a barn; the feet were supported in a heap of grain, and the knees bent forward so much that they were but a few inches from the grain. In another, a prisoner was found hanging to the bar of a window, so low that he was nearly sitting on the ground, and he had previously tied his hands together. In a third case, a prisoner hung himself in his cell, which was arched, and so low that in the highest part a man could not stand erect; yet he hung himself from the grating of the roof, and was found almost sitting down, with his legs stretched out before, and his hips within a foot and a half of the ground. In the fourth, a girl of the town suspended herself from the supporter of the little shelf in the cell. It was so low that she was obliged to stretch her legs and rest, the one on her heel, and the other on her toes, in order to accomplish her purpose. Again, a female was found stretched at the foot of her bed, the body lying on the floor, and the head and

shoulders supported by the cord attached to one of the posts of the bedstead.*

In these cases, the probability is that the pressure on the blood-vessels produces very early a loss of sensation and nervous power, and the individual is deprived of ability to prevent, even if he were then desirous, the fatal catastrophe.

As to the moral circumstances attending this case, Dr. Marc dwells much on the apprehension excited in the duke, by some remarks made at the evening party concerning the state of feeling in Paris against the exiled family. The fragments of a written paper were also collected on the hearth, in which he spoke of suicide. There is, however, a great contrariety of statement as to the deportment and state of mind of the deceased.

A third opinion suggested is, that the death by suspension was owing to accident. The duke was a veteran libertine; even at his advanced age he had his mistress (the Baroness de Feuchieres) living in the palace with him. It is a known practice with persons of this description, to cause themselves to be half hanged in order to arouse their dormant generative powers, and several have lost their lives from not being taken down in time.† Is it not possible that this might have been the cause of death?‡

* Besides these, which are only a portion of Marc's cases, others may be found in *Annales d'Hygiène*, vol. xi. p. 472. A boy in Connecticut, some years since, by way of curiosity, hung himself in a similar way. There is also an additional instance quoted by Dr. Bell, in his *Eclectic Library*, from the *Archives Générales*. A boy on being reprimanded by his father, and ordered to his room, hung himself from a nail in the wall five feet two inches above the floor. The feet were four inches from the floor, resting on a piece of plank, and the knees only four inches above this plank. The face was pale, the lips livid, tongue swollen and protruded from the mouth. The mark of the band used (a cravat) was unaccompanied by any subcutaneous or inter-muscular ecchymosis, but the skin was red in front, and on the right side there was abrasion of the epidermis. The brain was injected throughout. The cervical vertebræ were uninjured. (*Eclectic Library*, p. 33.)

It is evident that in many of these cases, in consequence of their position, the *mark of the cord must be horizontal*.

† Fatal cases are mentioned in the *London Medical Gazette*, vol. ix. p. 609; and *Lancet*, N. S., vol. ix. p. 49.

‡ The authorities consulted in this case are : *Annales d'Hygiène*, vol. v. p. 156; *Medico-Legal examination of the cause of the death of the Prince of Condé*, by Marc; *London Med. Gazette*, vol. ix. pp. 485, 608; *Albion news-*

Sarah M. Cornell, an operative (as the term now is) in one of the cotton mills at Fall River, Rhode Island, left her home on the evening of the 20th of December, 1832, in good health and spirits, and on the morning of the 21st was found dead, suspended to a stake. Her cloak was hooked together nearly its whole length, only one hook being loosened about the centre of the chest. Her calash was on her head, and her hands gloved; her shoes not on her feet, but stood about eighteen inches from the body, and there was a little mud on one of them. Her toes touched the ground, the heels being nearly perpendicular. The knees approached nearly to the ground, and the clothes were smoothed back as far as they would reach under her legs. The cord, which consisted of hemp, small in size, and taken twice round the neck, was attached to the stake about six inches from its top. Its length, from its fastening on the stake to the neck of the deceased, was short of six inches. Her calash was so far back on the right cheek that the face rested against the stake, and in consequence was distinctly marked by the pressure.

The cord was described by a witness who had followed the seas, as a *clove hitch*; two loops, one passing under and the other over. And he also added that it must be drawn at both ends horizontally in order to tighten it. The knot was at the right side.

The countenance was pale; and on dividing the cord, the strings of the calash were found under it. A deep horizontal indentation was found to extend exactly around the neck, and this was so marked that the neck below it measured eleven and a half inches, while at the mark its circumference was only ten and a half. It passed round the neck above the thyroid cartilage, an inch and a quarter below the tip of the ears on both sides. When the head was erect, the mark was higher at the back of the neck than it was in front. The tongue pro-

paper of February 11, 1832. I have followed the narrative of Marc in this case principally because it is the only one that I have been enabled to examine. (See also *Foreign Quarterly Review*, No. 54, art. 8, and No. 63, art. 3, and *Blanc's History of Ten Years, 1830-1840*, vol. i. p. 277.) This last author evidently favors the idea of murder, although the prevailing opinion is, I apprehend, in favor of suicide.

truded slightly. Several females, who prepared the body on the same day that it was found, for burial, deposed that there were marks as of the print of fingers passing upward on the abdomen; that there were bruises on the legs, but the worst one was on the back of the hip. There were scratches on the knees, with some dirt. One knee had the appearance of being stained with grass, and one witness (a female) indeed swears that she picked grass from it. The vagina was bloody, so that her linen was stained; the fæces evacuated and flattened. The right arm was raised upward, quite stiff, under the cloak.

A coroner's jury was summoned. A physician who appeared before them, inclined to the idea of suicide, particularly as he was aware of her pregnancy from previous consultation with him, and also by noticing the fullness of the abdomen. A verdict of suicide was accordingly brought in, and she was interred on the 22d, the same day on which her body had been found.

Suspicious, however, arising, the body was taken up again on the 24th, and a further examination made by medical men. The indentation on the neck looked like parchment; the stomach was healthy; the lungs gorged with black blood; the abdomen was livid and discolored; but they do not speak of the marks of fingers. They observed, however, the scratches and bruises on the knees and legs, and the discoloration of the former as if by grass; the contusion above the hip was also noticed. At the same time the uterus was examined, and a fœtus found; the os tincæ was open and dark, but the rest of the uterus was healthy; the membranes were not ruptured.*

A subsequent examination of the body was made on the 26th of January, but the facts elicited were of but little importance, as it is impossible, from the evidence, to discriminate between those which may be deemed the result of advancing putrefaction, or of injury during life.

Such are I believe all the important circumstances that make up the medical testimony in this case. It remains to consider it in reference to the questions already proposed.

* The facts relative to the fœtus and its probable age, I have noticed in a previous chapter. (See vol. i. p. 386.)

Was the female suspended while living? In answer to this, I would premise the remark that death was evidently caused by strangulation, using that word now in its most extensive sense. The absence of any other injury sufficient to account for it, the mark of the cord, the condition of the lungs, the fæcal discharges, and the condition of the vagina, if we determine to explain that without the idea of an attempt at abortion, all unite to render this opinion probable, and indeed certain. But in agreeing to this, we have only approached to the difficult part of the subject. The horizontal mark extending all around the neck, the deep indentation made, combined with the position of the body, and the peculiar character of the cord, all render it doubtful whether hanging was the immediate agent. Add to this the marks of injury on various parts of the body, which, at all events, are not incompatible with the idea of previous violence. Professor Channing, whose able replies, during an examination of at least three hours, cannot be too much commended, in answer to the question, replied that he thought the mark might be horizontal "if the body were nearly on the ground, and suspended from above. In such a case, the body falling forward, the mark of the cord on the back of the neck, or the side nearest the place from which the cord was suspended, would not be apparent at all. I knew," says he, "an instance of suicide of this kind; there was very little oblique pressure in that case; the mark was directly across the windpipe, and but little appearance elsewhere."

In further support of the idea of hanging during life, the absence of *two* marks around the neck, the calmness of the countenance, the inability to discover any indications of struggling in the stack-yard, and the impossibility to strangle a person with a cord so near the ear, were urged.*

On the other hand, the state of the clothes, the shortness of the cord, just long enough to go round the neck and fasten to the stake, the probability that the pressure of the body on it would have altered the mark from its horizontal position to

* On this trial, Dr. Channing testified that he had seen some fourteen cases of people hung, and in most of these the countenance was pale. Dr. Dunn, of Newport, confirmed this from the observation of four cases.

one tending upward, were dwelt upon to establish the idea of murder. And in connection with this, the idea has been advanced, that the marks of violence, and particularly those on the female organs, being indicative of a struggle, she may have been in a fainting fit when strangled and suspended.

The character of this female was decidedly bad. She had indulged in habits of incontinence for years, and was now pregnant. So far her helpless and (if her charge as to the paternity was false) desperate condition is favorable to the idea of suicide. Seduction, however, and murder, too often follow each other.*

I commenced the examination of this trial with strong prejudices against the accused—prejudices, however, founded on a perusal of the testimony as published in our newspapers. After a careful and deliberate review of all the facts, with reference to the present work, I will only say, in the language of Professor Walter Channing, (in a communication with which he was kind enough to favor me,) that “every point is surrounded with difficulty.”

It is not by any means *certain*, from the *medical* testimony, (and that alone I desire to consider,) that Miss Cornell was murdered.

Mr. Webb (Lond. Med. Times, August 7, 1852,) gives the following case: The body was found lying on the abdomen, on a bed, the face looking downward. He was quite dead. Suspended from one of the posts of the bedstead was a leathern strap, which, passing over the upper end of the bedpost, was fastened to it at about ten inches below the top by being twisted and knotted around it. From this point a loop twenty-one inches long depended. In this loop was the head. The body presented no other mark of injury than a dusky-red line above the *pomum adami*, extending on either side, following

* I have examined the following pamphlets in stating this case: Report of the trial of E. K. Avery, for the murder of S. M. C., by Benjamin F. Hallet, Boston, 1833. A report of the same, published by Marshall & Brown, Providence. Strictures on the case of E. K. Avery, by Aristides. Vindication of the result of the trial of E. K. Avery. A manuscript communication from Dr. Graves, of Baltimore, has aided me, and also an analysis of the case in Boston Med. and Surg. Journal, vol. viii. p. 334.

the base of the jaw in a curved line from the angle to a point above and behind the mastoid process, where it terminated. Here the weight of the body was chiefly on the bed, only that of the head and shoulders rested on the loop.

All these cases should teach us the lesson of caution in forming opinions in these cases, especially in basing our opinions of the improbability or impossibility of suicide on the position in which the body may be found; all the facts should be most carefully scrutinized before we decide. Marc's report on the suicide of the Duke of Bourbon is a model for such investigations.

The following analysis of the Experiments and Observations of Dr. Casper on Hanging is retained together, as a commentary on the foregoing section:—

The principal object of these experiments was to determine whether any evidence of hanging during life could be obtained from the *impression of the cord* on the neck. The result was in accordance with that obtained by Orfila, viz.: That ecchymosis is far from being a common occurrence; and of course, its non-production is not to be deemed as a proof of hanging after death. The following case was communicated to the author by Dr. Hinze, of Waldenburg, in 1826: A young man, in a fit of drunkenness, hung himself with a stout cord. He was cut down in half an hour, and efforts were made to revive him. The cord had merely produced a superficial mark on the neck without any appearance of ecchymosis. Signs of returning animation having manifested themselves, the medical attendants continued their efforts for several hours, but without success. At this period, however, when life was about to become again extinct, the *mark* on the neck became deeply *ecchymosed*, and this condition was verified the next day on dissection. Death was owing to sanguineous apoplexy.

Dr. Casper performed eight experiments on the dead subject. In the first, a man, *an hour* after death from typhus, was suspended by a double cord passed above the larynx. In about twenty-four hours, the body was cut down and examined. Around the neck, between the larynx and os hyoides, was a double parallel mark about three lines deep, *of a brown color with a slight tinge of blue*. There were traces of cadaverous ecchymosis about the body. The whole appearance was such that any individual not acquainted with the circumstances would have supposed that the deceased had been hanged while living. Some spots on the right side of the neck were strongly colored. The skin of this part was hard like leather, and in patches slightly excoriated. There was no extravasation of blood in the cellular tissue, but the muscles of the neck beneath were of a deep-violet color. The large vessels of the neck were not congested. In the two next cases—a young

man, aged twenty-three, suspended *an hour* after death from phthisis; and a man, aged seventy, *two hours* after death from dropsy, each by a double cord, and the bodies examined on the following day,—the appearances were similar. There was a double depression around the neck, and of a *yellowish-brown color, without ecchymosis*. The cutis was as if burnt, and like parchment, both when felt and cut. There was no blood extravasated in the cellular tissue beneath. Again, *thirteen hours* after death, a cord was drawn very tightly around the neck and above the larynx of a man dead from apoplexy. Six hours afterwards, a soft impression, easily removed by pressure, was perceptible on the constricted part. There was no color, nor was there any change whatever on the skin. Scarcely any impression was made on the neck of a female with a double cord applied *six hours* after death, and examined the next morning. In two succeeding experiments, the double cord applied as before, *twenty-four hours* after death, left a slight double depression; but there was no alteration of color nor any change in the skin, either on the surface or beneath. Lastly, a small cord was tightly drawn and secured around the neck of a child a year and a half old the day after death. Twenty-four hours afterwards, it was found that a small bluish-colored mark had been produced by the constriction. This mark, although very superficial, was still visible enough to strike the eye. There was no trace of extravasated blood on cutting into it.

It thus appears that when suspension is made within *two hours* after death, the appearance of the skin will be similar to what occurs when persons are hung alive, but not at the end of *six hours*. The result in the intermediate period has not yet been determined.

Dr. Casper has collected, principally from various medico-legal reports, a statistical account of 106 cases of hanging, 77 males and 29 females. The means of suspension were, a cord in 51 cases; handkerchiefs, bandages, stockings, in 25; unknown, 30. In sixteen cases out of nineteen, it was found that the use of a handkerchief did not prevent the formation of a visible mark around the neck; and, on the whole, the author thinks that the article used for suspension has but little influence on the local changes produced. This, however, is doubted by his English commentator, who suggests that a hard ligature like a cord is more likely to produce ecchymosis and excoriation, as well as to leave a more visible depression on the neck than a soft material like a cravat or handkerchief.

The exact site of the ligature is also deemed of little consequence, either in respect to the formation of a mark by the cord or to the manner in which death takes place, that is, whether by apoplexy or by asphyxia. In regard to the position of the ligature, it was found to be between the os hyoides and larynx in 59; on the larynx or thyroid cartilage in 9; position undetermined in 38. The local changes in the mark itself were as follows: Accompanied by ecchymosis and subcutaneous extravasation, 21. Of a yellow color, without ecchymosis or extravasation, 50. Unknown, 35.

Thus, out of 71 cases of hanging during life, only 21 were accompanied with true ecchymosis in the depression produced by the cord, or in the ratio of *two to seven*. The white or colorless depressions were mostly met with in fat subjects. The time during which the ligature remained around the neck of the individual hung was observed to make no difference as to the produc-

tion or non-production of ecchymosis by it. Whether it was removed sooner or later after death, ecchymosis was sometimes found, and at other times not.

In the 106 cases, death took place from apoplexy in 9; asphyxia, 14; both conditions, 62; neither, 5; unknown or unexamined, 16.

The mark was not ecchymosed, as well when the vessels of the brain were empty as when they were congested. And in none of the apoplectic cases was blood effused on the brain; there was merely more or less congestion in the sinuses and vessels. This, then, should be understood as the meaning of the term apoplexy in these cases. It is caused by an obstruction to the circulation in the brain, and on this depends the lividity of the countenance; for when the circulation of blood is impeded in the chest, before the cerebral obstruction takes place, the face of the hanged person will not be livid. In some instances Casper found it extremely pale.

Out of 77 cases, the emission of semen, or rather of the *liquor prostaticus*, occurred in 19. Evacuation of the fæces, in four cases out of 106. Casper found a vascular and congested state of the female organs of generation but once in 29 cases. Erection of the penis probably occurs frequently, but the examination should be made soon. In nine cases mentioned by Guyon, traces of this erectile state were perceived *an hour* after death.

The inferences drawn from the above facts and experiments need hardly be recapitulated. The most important is, that the mark produced by the ligature is not to be depended on as an evidence of hanging during life. It may be produced a *short time* after death. Dr. Casper applied this to the case of a female accused of infanticide. The child had evidently respired; and the medical examiners ascribed its death to strangulation by the band of straw found around its neck. The depressions caused by each straw were *whiter* than the rest of the surrounding skin, and the little folds or elevations of skin between the straws were *red*. On cutting into these red spots, it was found that in some of them the discoloration was owing to true ecchymosis in the cutis. The female was found guilty, and sentenced to be whipped and confined for life. Dr. Casper, however, whose opinion was called for, on an appeal from the sentence, declared that it could not be positively assumed that the child was living when the ligature was placed around the neck. This might have been done within *the hour* after death. In consequence of this declaration, a mitigation of punishment followed. I agree, however, with the gentleman commenting on this case, that this is wresting the case altogether from the jury. It is, at best, stretching the result of our author's experiments to, if not beyond their legitimate limits, since in the subjects hung within an hour after death, there was no semblance of ecchymosis.

Two cases are mentioned as occurring to Dr. Casper, where hanging was resorted to by a murderer, in order to conceal his crime. One was of a boy found hanging. A round ecchymosed mark, of the size of a shilling, was seen on the larynx, with several impressions on the surrounding skin. There was neither depression nor ecchymosis in the course of the cord around the neck. The boy had been first strangled and afterwards hung.

In the second case, a man aged sixty, was found suspended to a hook in the door, so that the nates were only nine inches from the floor, and his legs were stretched out at full length. The cord by which he was suspended was from two to three feet long, and was loosely passed around his neck. The

furniture of the room was in great disorder. Some marks of dried blood were seen on one part of the floor. The right side of the head and face of the deceased, was, in several parts, ecchymosed and excoriated. A circular impression had been produced in the neck by the cord, but there was no extravasation beneath. A little above this was a strongly ecchymosed mark, extending round about one half of the neck to the occiput. In the skin beneath this, blood was found extravasated. The medical opinion given was, that the deceased had been murdered previous to suspension; and evidence subsequently produced confirmed this. (British and Foreign Medical Review, vol. v. p. 615.)

H. *Of persons found strangled.*

The distinction between strangulation and hanging has already been noticed. The distinction consists essentially in the body not being suspended. It is a not very uncommon mode of homicide, while hanging is exceedingly rare; a greater amount of violence is commonly inflicted on the neck, and we expect more distinct marks of such injuries, as the mark of the cord, etc. Suicide by strangulation is very rare, so that when it is established, the presumption is always in favor of homicide; where hanging is the mode of death, the presumption is of course equally strong in favor of suicide.

The diversity that occurs in the external appearance is to be explained in a similar manner as those seen from hanging. The instrument of murder varies considerably, from a cord to the application of the hands. The simplest form is probably the bow-string, as practiced by the Turks. Here the ligature is applied round the neck, and drawn so tight as to interrupt at once the alternate entrance and exit of air by the windpipe.* But in ordinary cases, death is not so rapidly produced. There is more or less of struggling; and I apprehend that in by far the greater number of cases, suffusion and distortion of the face will be seen, depending, in degree, on the length of the conflict.

It may also be, if the cord is removed some time previous to the inspection of the body, that the lividity of the face, and other signs of turgescence about the head, have gone off, from the fluidity of the blood and the position of the head.

The mark of the ligature will generally form a *horizontal*

* Edinburgh Medical and Surgical Journal, vol. xxxix. p. 396.

discolored circle round the neck, and toward the lower part. The dislocation of the vertebræ is not to be expected, though there may be fractures of their processes, and, in all probability, injury to the cartilages of the larynx.*

The appearances on dissection will not vary materially from those stated in the previous section, except that in cases of manual strangulation they will not be so distinct, since the imperfect closure of the windpipe has allowed respiration and circulation to go on for a longer time.†

The same questions are to be considered here as in the former section. *Was the deceased actually strangled, or was the rope fastened around his neck after he was dead?* There are instances on record where injuries have been inflicted on bodies strangled, to avert suspicion of the true manner in which they were killed.

I commence with one, which, even at the distance of a century and a half, is still a vexed case. It acquired an importance from its connection with the distracted state of England in the reign of Charles II., the supposed murder being attributed to the Catholics. I discard this idea altogether. The Popish plot was engendered in fraud, and no credence can with justice be given to any of its perjured inventors. I will state the case simply as it comes down to us, from the narrative of eye-witnesses of the testimony and responsible observers:—

Sir Edmundbury Godfrey, an eminent magistrate in London, was, on the 12th of October, 1677, found dead in a ditch, nearly a mile out of town. His sword was thrust through him, but there was no blood on his clothes or about him. His shoes were clean. His money in his pocket. His neck, which was open, without anything on it, had a mark all round, an inch broad; it was also dislocated. The breast was marked with bruises.

This is the statement of Bishop Burnet, who went to see the body.

Subsequently, several individuals were tried in the court of king's bench for publishing letters importing that Sir E. Godfrey *had murdered himself*. Though a case of libel, they endeavored to defend themselves by calling witnesses to prove

* Smith, p. 224.

† Beatty, ut antea, p. 333.

the truth of the fact, and this the chief justice (Pemberton) allowed to the fullest extent. The medical testimony is as follows:—

Two wounds were found on the body, within an inch and a half of one another. One went no farther than the bone, having struck on a rib, and the other through his back. When the sword was drawn out blood followed. The neck was very flexible. The face was bloated, and the eyes bloodshot. The upper part of the breast was much discolored. And Mr. Lazinby, a surgeon, deposed that the marks on the neck were very distinct, with a swelling above and below them.

It is urged, in opposition to these striking facts, that Sir E. Godfrey was of a melancholy temperament, and labored under a great depression of spirits; that he probably destroyed himself under the operation of this feeling, and that the mark around the neck might be owing to the tightness of the collar.*

Philip Standsfield was tried and found guilty, in 1688, of the murder of his father, Sir James Standsfield, of New Milns, in Scotland. This atrocious parricide appears to have been a man of vicious and debauched habits, and on extremely ill terms with his parent. He cursed him, and repeatedly swore that he would take his life. The father was murdered by strangulation in his bed-chamber, at the dead of night, and the body was afterwards carried to some water hard by. In the morning it was discovered lying on the top of the water, which was only five feet deep, and not a running stream, and although Philip was desired to delay the burial, yet he caused it to take place.

* Hargrave's *State Trials*, vol. ii. pp. 759 to 791, vol. iii. pp. 505 to 518; Burnet, vol. ii. p. 42; Smith, p. 225; Hallam's *Constitutional History of England*, American edition, vol. ii. p. 574; *Edinburgh Review*, vol. liii. p. 39. Compare with these Lingard's *History of England*. The reviewer in the *Edinburgh Medical and Surgical Journal*, vol. xxii. p. 191, observes that the proof of strangling in this case is quite inconclusive, and animadverts with perfect justice on my introduction of the testimony of Oates' gang. In the present narrative, I have omitted this altogether, but I am still inclined to consider the case as one of strangling. (See *Baltimore Medical and Surgical Journal*, vol. i. p. 34.)

"We must say that after having read and weighed all the evidence now extant on that mysterious subject, we incline to the opinion that he (Godfrey) was assassinated." (*Edinburgh Review*, vol. lxi. p. 159, American edition.)

Suspensions were, however, excited, and two surgeons were sent from Edinburgh, by order of Sir John Dalrymple, the king's advocate, to examine the body. They (James Murehead and James Crauford) found the following appearances, which I shall give in their own words: "Having, with all possible exactness, viewed the corpse, we observed the face a little swelled, and inclining to a dark-reddish color, some fullness of some capillarie veins in the pallat of the mouth towards the uvula, as also a large and conspicuous swelling, about three inches broad, of a dark-red or blue color, from one side of the larynx round backwards to the other side thereof; we observed the jugular veins on both sides the neck very large and distended, and full of blood; there was a large swelling under and betwixt the chin and cartilago scutiformis; there was also a little scratch below the left mandibula, which had rankled the cuticula, and made some little impression on the cutis. Having made incisions from the chin down about the larynx, and cross upon the swelling of the neck, we found a greater laxness and distance (as we think) than ordinary betwixt the cartilago scutiformis and os hyoides; we found the tumor on the neck containing bruises, like dark or blackish blood; the jugular, when cut, bled considerably, especially that on the left side.

"Having opened his breast, we found the lungs distended to the filling up of their capacities, but free of water; his stomach, liver, etc., were all in good condition; we found no water within the corpse; the corpse had no smell at all; the breast, belly, privy parts, etc., were all well colored; there was no swelling in his belly, nor anything but ordinary to be seen on his head."

This report was submitted to the deaconry of surgeons at Edinburgh, and they state, "*that though it is not usual to declare more than matter of fact,*" yet they, in obedience to his lordship's commands and inquiry, whether these symptoms import drowning or strangling, reply, that they indicate external violence, and such as could not be caused by drowning simply. On that part of the report, which details the appearances found on opening the breast and stomach, they observe that *a body, when drowned, is generally found to have much water in it.* As this was not present in the deceased, as the lungs were dis-

tended, but free from water, and as the other circumstances mentioned in the report indicated violence, they decided that there were just grounds to think that he was not drowned.

The college of physicians were also consulted, and answered that there was sufficient reason to believe that Sir James had been strangled, and not drowned.

Spurway, a person present at the dissection, proved that when surgeon Murehead was moving the cap from the head, the eyes opened, and the eyelids were much swollen and very red.

The defence set up was, that Sir James had drowned himself; and in reply to the argument that no water was found in the body, it was urged, that when a man commits suicide in this way, he will keep his breath, and thus prevent the ingress of the water. Various conjectures were also advanced in the pleadings to account for the swelling of the neck, but did not prove satisfactory, and the parricide was, with great justice, condemned and executed.*

I shall adduce another case, to show the facility with which a person may be murdered in this manner: Dr. Clench, a physician in London, was called out of bed by two persons, on the night of the 4th of January, 1692, who desired him to visit a friend who was not well. He entered a hackney-coach with them, and drove about several streets in the city for an hour and a quarter. The two individuals then left the coach, and sent the driver on an errand. When the coachman returned, he found Dr. Clench sitting on the bottom of the coach against the front seat, with his head against the cushion. Thinking him in liquor, he shook him, but obtained no answer. He then called the watch, and they found him strangled by a handkerchief, in which a coal had been placed, and then the coal ap-

* Hargrave's State Trials, vol. iv. p. 283. In Mr. Lockhart's Life of Sir Walter Scott, (vol. i. p. 151, American edition,) I find a remark of Sir Walter on this case: "It was believed at the time," he says, "that Lady Standsfield had a hand in the assassination, or was at least privy to her son's plans, but I see nothing inconsistent with the old gentleman's having committed suicide. The conviction appears very doubtful indeed." I bow with due reverence to such an authority, but I cannot avoid adding that the marks of violence were somewhat unequivocal.

plied directly over the windpipe.* The coachman had heard no noise while driving the carriage.†

It must, however, not be forgotten that strangulation is sometimes effected by other means than a cord, ligature, or handkerchief. It may be performed by the hand, and in this instance, instead of a circle around the neck, the discoloration will be partial, the bruises will be of an indistinct form, or the positive marks of fingers may be traced.‡

In 1763, a man named Beddingfield was murdered in England, and the charge was laid against his wife and man-servant. The medical testimony was very unsatisfactory, as no dissection had taken place, but it was proved that there were marks about the neck resembling those of fingers. A contradictory account was, however, given of the number; one surgeon said a thumb and *three fingers*, the other, a thumb and *four fingers*, while another, who also saw the marks at the inquest, spoke of *two* only, "which looked as if the blood was set in the skin."

The defence was, that the deceased had fallen out of bed in a fit of apoplexy, and was found lying on the floor on his face, with one hand round his neck.

I am far from thinking that this could have been mistaken, if a proper examination had been made. The discrepancies in the testimony, and the omission of dissection, might, however, have led to subsequent doubts, had not one of the condemned persons confessed that he had strangled Beddingfield, by seiz-

* "There is a caste of robbers in Upper India who strangle their victims by means of a cummerband, (a long piece of cloth worn round the waist,) in which a knot is cast, and thus, from the softness of the cloth, leaves little or no mark; they generally throw the body into a tank or well, and putridity in that country advances so rapidly that in twenty-four, or at most forty-eight hours after death, nothing can be found by which the cause of death could be traced." (DUNLOP.)

Dr. Dunlop probably refers to the *Thugs*, a fraternity of murderers by profession. An account of them is given in vol. lxiv. of the *Edinburgh Review*.

† Hargrave's *State Trials*, vol. iv. p. 495.

‡ These marks are occasionally very slight. A young officer was strangled in his bed by a soldier. The surgeon of the regiment could only find one small spot, which the murderer afterwards confessed he had produced by violent pressure with his thumb." (Metzger, p. 379.)

ing his throat with his left hand, while asleep, and that though the deceased struggled violently and made some noise, yet he soon accomplished this purpose.*

Sir John Dinely Goodere, in 1741, was forced by violence on board the Ruby ship-of-war, commanded by his brother, Capt. Goodere, and lying in the port of Bristol. In the night he was strangled by two assassins in the employ of his brother. One of them confessed that the other fell on Sir John, as he lay in bed, took hold of his throat with his hand, (his stock being on,) and so strangled him with his stock. They then put a rope with a noose in it round his neck, and drew it tight, to insure the certainty of the murder. In accordance with this, Mr. Dudgeon, the surgeon's mate of the Ruby, swore that there were some marks on his neck, which looked like the scratching of nails, while blood came out of his nose and mouth.†

"On opening the bodies of those who are murdered by manual strangulation, the usual appearance of this kind of death may not seem so conclusive as in other cases, from the person making continued resistance, and the functions of respiration and circulation going on in some measure for a longer period than when they are interrupted at once, as in the instance of drowning or the effectual application of a cord."‡

In the case of a woman who had been strangled *per manum* by two men, Littre found the tympanum of the left ear lacerated, and from it flowed about an ounce of blood; the vessels of the brain were unusually turgid; red blood was extravasated in the ventricles, and also on the base of the cranium; the lungs were greatly distended, and their membrane very vascular. Not more than an ounce of blood, however, was contained in the right ventricle of the heart, and it was fluid and frothy, like that of the lungs.§

In a case of murder by manual strangulation, detected with great skill by Dr. Paris, patches of extravasated blood were

* Smith on Medical Evidence, p. 290; Paris, vol. iii. p. 30.

† Hargrave's State Trials, vol. vi. pp. 816, 831. It is insinuated that Capt. Goodere was insane. See Croker's Boswell, vol. i. p. 332.

‡ Smith, p. 229.

§ Foderé, vol. iii. p. 139.

seen on the throat, with abrasions corresponding to the nails. On the chest, also, bruises were noticed. On dissection, the brain was found excessively turgid with blood, but all the other organs were healthy. The murderer, previous to execution, confessed that he had strangled his victim with a pocket-handkerchief, but from the difficulty of completing it, he was compelled to press his knees upon his chest.*

John Nuttal was convicted of the murder of his pregnant mistress at Lancaster, England, in 1817. She was found dead in a well: there were bruises on the forehead, chin, knees, and arms. On the neck there were marks of four nails, one under the right ear and another under the left jaw, and they had penetrated very deep, and were very distinct; connected with the nail-marks were those of fingers. The brain exhibited an effusion of blood; the dura mater was turgid; the vessels of the pia mater were, in many places, ruptured. The lungs were shrunk or collapsed, and there was no water in them or the stomach. There was a great accumulation of blood in the heart.†

Mrs. Getter was strangled, near Easton, Pennsylvania, on the night of the 27th of February, 1833, by her husband. She was strong and robust, with a stout thick neck, and a broad expanded chest. The next day an examination was made. The countenance was full and bloated; the lips tumid, and of a dark-bluish tint; the tongue slightly livid, but did not project beyond the teeth; the mouth was filled with froth, and the vessels of its lining membrane greatly distended; the jaws nearly closed; the eyes prominent and half open, and turgid; the ears and temples of a dark color, owing to engorgement of the veins. On the right side of the throat was an indentation, as if made by a thumb or finger-nail; it extended into the true skin, and was about half an inch long and the twelfth of an inch in width. There was also an abrasion of the upper part of the larynx.

On dissection, the veins of the neck bled very profusely; both carotids were empty. Beneath the muscles on the left side of the neck, toward the upper part of the larynx, was a

* Paris, vol. iii. p. 29.

† Remarkable Trials, vol. vi. p. 241.

slight extravasation of blood corresponding to the external mark. The windpipe was filled with frothy matter, and its lining membrane thoroughly injected; the diaphragm was arched; the lungs of a deep-black color, and filled with dark venous blood mixed with froth; the auricles and ventricles of both sides were filled with black blood, and the coronary vessels were much injected; the bladder was empty and contracted. All the other parts were healthy.

The brain was not examined. Regretting this omission, Dr. Gross was induced to perform some experiments on animals, for the purpose of ascertaining its state. Dogs and rabbits were the subjects, and they were strangled by the hand. In the former, the urine and fæces were discharged almost immediately after pressure was made. The external appearances corresponded to those observed in the human subject. The blood-vessels were in a similar state, but the lining membrane of the air-passages was white in two cases out of three. The lungs were not in every instance congested, but the heart was distended in each case. In the brain, the vessels of the dura or pia mater were injected; the cerebral substance was darker than usual; and in one instance there was a slight extravasation of blood at the base of the brain and an injected state of the membranes of the spinal column. In no case was there any blood in the ventricles of the brain, or any extraordinary congestion of its vessels.*

Mr. Watson gives us a case of a wife murdered by her husband. There was discoloration and swelling of the front part of the throat, and, on examination, it was found to contain extravasated blood. This ecchymosis extended from the lower jaw about three inches downward, on each side of the trachea, and it also existed in the substance of the left side of the thyroid gland. The membrane lining the trachea was redder on

* Dr. Gross, in *Western Journal Medical and Physical Sciences*, vol. ix. p. 25. Dr. Gross very properly cautions the medical examiner not to mistake the effects of apoplexy, hysteria, epilepsy, or intoxication, for those of manual strangulation. In each of the above diseases, persons suddenly seized with fatal symptoms may, in their agony, apply their hands to the throat, and thus produce marks on it. The nature of the case, however, will generally explain these, if a cautious inspection be made.

one side than on the other for more than three inches. The lungs were dark-colored and much congested. The heart was empty. All the other viscera were healthy.*

I will only add the following from Devergie: On the 25th of January, 1831, Mrs. Duval was found dead in her chamber. There was an enormous wound of the throat in front, dividing all the parts down to the vertebræ, but the carotids and jugulars were uninjured. The superior thyroid artery had, however, been divided, and it was evident during life, since coagulated blood, in the form of jets, was largely deposited on the adjacent parts. On further examination, the following additional lesions were discovered: a fracture of the left lateral bone of the os hyoides, a transverse section of the thyroid cartilage with a vertical fracture of its left portion, and a double fracture of the

* Watson on Homicide, p. 129. The following case was sent to me several years since by Dr. Raymond, of Buffalo; but I am not aware as to the result of the trial:—

Larckom, a farmer, aged twenty, was a passenger on board of a canal boat, of which Flint was captain. After a few angry words had passed between them, Flint seized Larckom by the collar of his coat, then kicked at his genitals, and afterwards threw him on the deck. Larckom called for help, which was immediately rendered. When the prisoner was taken off, he was observed to remove his hand from the throat of Larckom, *who was dead*. The whole affray did not continue more than five minutes. The deceased wore a bombazine stock.

The body was examined, five hours after death, by Dr. Raymond and other physicians. The head, neck, and face were of a mahogany color; the ears deep purple. There was a blue spot as large as the hand just over the breast-bone, where the cutaneous glands appeared as if dotted with ink. No marks of fingers or nails could be detected on the neck. The veins were turgid; the eyes and mouth closed, and lower jaw fixed. The thorax and abdomen presented no marks of violence. The penis was semi-erect, and semen had been emitted. The scrotum was not discolored. On the left knee there was a slight scratch. The muscles were rigid.

An incision was made from the chin to the pelvis. The upper surface of the tongue was of a dark blue. On dividing the skin of the neck, black blood flowed from the vessels, but no extravasation was found under it. The deep-seated veins were distended with blood, and the arteries empty. The lungs of a leaden hue, and the heart, at both sides, filled with fluid blood. The viscera generally were healthy.

One or two drops of blood were effused into the cellular tissue of the scrotum, but no marks of injury could be detected in the testicles.

On dividing the scalp, more blood than usual escaped from the vessels, and the same was observed on elevating the skull-cap.

anterior part of the cricoid cartilage. There were some slight contusions on the body.

The internal organs were healthy, the right side of the heart was empty, and the left gorged with blood.

Now here was a case, which at first might appear to be suicidal, yet it was impossible but that the injuries in question must have been inflicted previous to cutting the throat, and the medical examiners accordingly gave it as their opinion that manual strangulation had been first attempted, and then the murder was completed with a cutting instrument.*

As to the question, *whether the strangulation is the effect of suicide, homicide, or accident*,† it may be observed that it would appear extremely difficult for a person to destroy himself in this way, since the hands lose their strength the moment compression begins. Cases, however, are so numerous where the object has been completed, and where no reasonable doubt can exist as to the cause, that we cannot deny its possibility. All marks of violence are, however, of course proofs of homicide, and the circular mark itself is *prima facie* evidence, unless contradicted by sufficient testimony.

As illustrations of the remark just made, I may mention several well-authenticated cases. The following were commu-

* Devergie, vol. ii. p. 169.

† I quote an *accidental case*, as an illustration, out of many that have happened: On Monday, January 16, 1845, Mr. Baker held an inquest on the body of William Laurence, aged eighteen, employed by Mr. Martin, paper-glazer and embosser. On the previous Friday evening, deceased was about to glaze some paper at a one-horse power steam-engine, and was passing a proof-sheet between its rollers, one of which is of hollowed brass, heated by a red-hot round bar of iron in the manner of a tea-urn. He wore at the time a neckerchief, tied sailor-like, with the ends depending loosely and long. The sheet of paper he was trying, missing its bite, slipped, and as he stooped to catch it, the ends of his neckcloth got beneath the brass roller, and he was drawn in, with his neck and side-face tightly against it. He cried out, "Stop the engine;" and two fellow-workmen hearing the appeal he made, hurried to his assistance, and did so. They then unscrewed the rollers and extricated the deceased. He sighed heavily once or twice, and expired. Mr. Matcher, a neighboring surgeon, pronounced the cause of death to be strangulation, and accounted for its suddenness, through the close contact of the deceased's visage with the heated roller. Had it been cool, since he was so expeditiously extricated, he might not have been strangled. Verdict, "Accidental death." (London Illustrated News.)

nicated by Dr. Desgranges, of Lyons, to Foderé, in 1811: A man was found in a hay-loft, strangled by a handkerchief, which had been tightened with a stick. The judicial tribunal consulted the Society of Medicine, whether this was a case of possible suicide. The Society replied *that it was possible*; and Dr. Desgranges observes, that in a person who is firmly determined to destroy himself, it might be accomplished by producing several rapid revolutions of the stick, and in this way tightening the handkerchief effectually.*

In another case, an old man in the hospital used the handle of a pot as the instrument for tightening the ligature. He was found lying on the bed, with his face turned to the mattress; the chin was cut by the pieces of the pot; the head was dark colored, the face swelled, the lips thickened, and a sanguineous saliva issued from the mouth.

In 1834, an insane female strangled herself, at the Hôtel-Dieu, by tying a handkerchief round her neck from behind forward, and taking a knot, and then returning it and making a second one. She was seen alive in her ward an hour previous, and was found inanimate, with her head hanging out of the bed. The eyes were much injected; the mark of the ligature was deep, ecchymosed, and partially excoriated. What adds to the interest of this case is the fact that the right hand wanted four of its fingers. It is well asked whether the presumption would not have been almost irresistible of murder, if this female had been thus found in a solitary place, instead of the open, frequented ward of a hospital. Dupuytren, in remarking on it, observes that in these cases strong proofs are often derived from the posture and features of the deceased.†

* Foderé, vol. iii. p. 173. "A navy surgeon, a friend of mine, related to me the case of a Malay, who, on board of a man-of-war in the East Indies, had made repeated attempts to commit suicide; and at last succeeded by the means alluded to in the text. He tied a handkerchief round his neck, and with a small stick twisted it several times, and then secured it behind his ear to prevent its untwisting. Jealousy was the cause assigned for the act." (DUNLAP.)

† Annales d'Hygiène, vol. x. p. 152; London Medical Gazette, vol. xii. p. 126. Similar cases are related in Annales, vol. viii. p. 429; London Medical Repository, vol. xxviii. p. 347; British and Foreign Med. Review, vol. vii. p. 261.

Case of Gen. Pichegru. Pichegru was confined as a State prisoner in the Temple. On the 5th of April, 1804, he was as well as usual, and at ten o'clock in the evening the keeper locked the doors of his prison, and took the key. The general was heard to cough during the night, but at seven o'clock, when they came to light the fire, he was found dead on his bed. A commission was appointed to examine the body, among whom were several medical men. They found, twelve hours after death, a circular mark around his neck about two fingers wide, produced by a black silk cravat strongly knotted, and through which a small stick had been passed. The stick was used as a tourniquet to produce the strangulation. They also remarked that one end of the stick lay under the left cheek, where, by an irregular motion of the body, it had caused a slight scratch. The face was ecchymosed, the jaws fixed, and the tongue held between the teeth. The body was swollen, the extremities cold, and the muscles of the hands and feet strongly contracted.

From these observations, and taking into view the position of the body, they were of opinion that General Pichegru had strangled himself.

The next day a medical dissection was ordered. The dura mater was injected and slightly adherent. The blood-vessels of the brain filled with blood. The other portions were healthy. So also were the viscera, except that the lungs were gorged, and the stomach reddish. The œsophagus was healthy, except at the mark of the handkerchief. The examiners repeated their opinion of its being a case of suicide.

Chaussier very justly condemns the palpable deficiencies in these reports. The appearance of the eyes is not noticed, nor

The following is extracted from the London Atlas newspaper of November 24, 1838: "Late on Tuesday evening last, an inquest was held at the Blue Anchor, St. Mary-at-Hill, on the body of Robert Watson, aged eighty-eight, who put a period to his existence in the following determined manner: On Sunday evening he retired to his bedroom at about half-past eleven, and told witness to call him by ten next morning. At the hour appointed, witness found him with his night-cap drawn over his face and neck, and fastened round the latter by a silk handkerchief. Through a loop-knot in the handkerchief, deceased had inserted the poker, which he had twisted tightly round, and which he still held firmly clenched in both hands. He had made use of the poker in the way that a smith does the handle of a vice."

the position and attitude of the body. We are not informed at what part of the neck the mark was, whether the inferior or the superior, or how deep, or of what color.

As to the dissection, it is superficial, notices points which are of no importance, and slurs over the most important subject of inquiry, viz., the state of the neck.

• I apprehend that no one can read this statement, and it contains all the medical facts we have on this historical case, without inclining to agree with Chaussier, that although the medical witnesses might be justified in declaring it a case of strangulation, they had no grounds for pronouncing it suicide. Still this is within the range of possibility, if we credit the narratives already given.*

There is another class of cases that may be mistaken for either suicidal or homicidal strangulation, and these lead to grievous mistakes. I refer to instances of apoplexy, occurring in unusual positions of the body, where a strong pressure is

* Chaussier, p. 279. I subjoin the statement given by one, who, if Pichegru was murdered, might probably have directed the commission of the crime: "He was lying," says Savary, Duke of Rovigo, in his memoirs, "on his *right* side; he had put round his neck his own black silk cravat, which he had previously twisted like a small rope; this must have occupied him so long as to afford time for reflection, had he not been resolutely bent on self-destruction. He appeared to have tied the cravat, thus twisted, about his neck, and to have at first drawn it as tight as he could bear it; then to have taken a piece of wood, of the length of a finger, which he had broken from a branch which yet lay in the room, (part of a faggot, the relics of which were still in his fire-place;) this he must have slipped between his neck and his cravat, on the right side, and turned round till the moment that reason forsook him. His head had fallen back on the pillow and compressed the little bit of stick, which had prevented the cravat from untwisting. In this situation apoplexy could not fail to supervene. His hand was still under his head and almost touched this little tourniquet."

"No human eye," says Sir Walter Scott, "could see in the dark recesses of a State prison; but there were not wanting many who entertained a total disbelief of Pichegru's suicide."

The defective state of the reports, and the evident reluctance of the medical men to pursue the investigation, appear to me most mysterious, if this was a case of suicide. Under other circumstances, French medico-legal examiners rather err in the opposite extreme—in being too diffuse and minute. Bonaparte, however, when at St. Helena, steadily denied that Pichegru had been murdered. "The very uncommon mode of his death," he said, "proved the contrary."

necessarily exerted on the neck, and phenomena of strangling indeed, both external and internal, are more or less developed. Several well-ascertained cases of this description, where no doubt could exist as to the cause, are mentioned in the journals;* others again, have been made the subject of legal investigation.

In a recent instance in France, two individuals were sent to the galleys for the supposed murder of an intoxicated person, by strangling; nor was it until after a long revision of the case, and the production of the positive opinion of Foderé, Marc, and others, that the case presented not a single feature beyond that of ordinary apoplexy, that the sentence was reversed. The physicians who examined the body, and who deposed on the trial, gave a similar opinion; yet popular prejudice was sufficient to condemn the accused.† A somewhat similar case happened some years since in New York.

Frederick L. Teige, a man advanced in years, and who, a few weeks previous, had arrived in this country from Switzerland, was found dead in New York, on the morning of Saturday, the 28th of May, 1825. He lay in a gutter on his face, and underneath his face, which did not touch the earth, in consequence of the narrowness of the gutter, was a puddle of congealed blood, extending from ten to fourteen inches. On raising the body, fresh blood was observed on the nose and face, and

* Annales d'Hygiène, vol. ii. pp. 440, 447.

† Annales d'Hygiène, vol. vii. pp. 568, 615. The deceased individual, when last seen was extremely intoxicated. His body was found *stiffened*, but still so *warm* that many disbelieved that life was extinct. The face was downward, reclining on the breast, and the trunk and inferior extremities rested on the end of the toes and the right knee. It appeared, indeed, says one of the medical counsel, as if the deceased, finding his inability to return to the erect posture, had forced himself backward and upward on all fours, and in this position was struck with apoplexy. The absence of all marks of violence, the very early period at which the body was discovered, and the presence of *spasmodic rigidity*, (see page 43 of this volume.) all render it probable the cause of death was *accidental*. Another case, in which the presence of *spasmodic rigidity* was insisted on in order to relieve the prisoner from the charge of murder, is that of Robert Reid, of Edinburgh. The medico-legal examination was evidently very imperfect, and this, of course, led to great diversity of opinion. The details are given in Watson on Homicide, pp. 70, 266. And the remarks of the late Dr. Fletcher on the trial are published in Ryan's London Medical and Surgical Journal, vol. viii. p. 65.

indeed some dropped from the face while in the act of lifting him. The right hand lay upon his back, and the right foot was drawn up. The body lay at the foot of a declivity of about twelve feet, and the bank was composed of very loose sand. No marks of struggling, such as breaking away the sand, were noticed, and there was no sand on his back. His hat lay somewhat on the hillock, and there were marks of five or six steps on the bank, of one person.

The coroner stated that around the neck of the deceased, and between his vest and shirt, there was a loose green cord. The neck-cloth was very tight, as also the shirt-collar,—so tight, indeed, that the witness could scarcely introduce his finger between the neck and collar, and, after unbuttoning it, he could not have buttoned it again. None of the clothes were torn, nor was the cravat out of place. On the neck the marks of a thumb and three fingers were visible, but he could not say whether they were of the right hand or the left hand.

Dr. Graves, who examined the body in the first instance, stated that there was a slight wound on the left temple, and an abrasion of the skin on the top of the nose, while on the right side of the head the skin was rubbed off to the extent of a dollar in size. The skin was also rubbed on the right and left side of the throat. On removing the skull-cap a large quantity of serum was discovered.

Drs. Francis and Anderson, who subsequently made an examination, found the countenance very turgid, the eyes protruded, the tongue pressed firmly against the teeth, and on the neck a strong mark, distinctly visible, and nearly as low down as the collar of the shirt. The jugulars were distended, and the neck swollen. The right side of the heart was engorged, and also the lungs. The larynx, in its internal surface, was discolored, owing to the effusion of blood. No marks of injury appeared on the body.

It was proved on the trial that the deceased was a stout, athletic man, of a large neck and full frame; that he had been for years in habits of gross intoxication; that he had been drunk every day of the week of his death, and extremely so on the Friday evening at ten o'clock preceding the Saturday morning when he was found dead.

Two of his countrymen, who had come over with him in the same vessel, were charged with his murder; but the evidence against them was so slight, that the jury acquitted them without leaving their seats.*

The grand medico-legal question in this case evidently is, *whether death was caused by accident or design*. I incline to the former opinion; from the habits and make of the deceased, from the external appearance and position of the body, from the extreme tightness of the shirt-collar acting on this state and position of the body, and from the absence of other marks of injury. Among the doubtful circumstances, however, are the marks of fingers on the neck; but it is possible that these may have been made by the deceased himself, in an effort to unbutton his collar. The appearances, on dissection, will of course apply to either supposition, while the blood was evidently discharged from the nose.

The following case is reported in the French journals: A female, aged eighty years, was, on the 11th of June, 1845, found dead, hanging from a beam in the house where she resided. This house belonged to B. Buscatel. It consisted of two rooms on the ground floor, and a loft above, which was not planked throughout, except with a few loose boards directly over the place where the bed of the female was placed. She hired one of the above rooms, and Buscatel and his family occupied the other. The body was found hanging from one of the beams in the middle of the room, by a cord, which formed a running double-knot round the neck. One end was thrown six times round the beam, and the other, which was loose, was thrown over a pile of vine faggots.

The ends of the toes were about three inches from the floor, and at about four inches from them, in front of the body, was a chair turned over on its back. Behind the body was a ladder resting on the beam, to which the end of the rope had been attached. The head of the female was uncovered; her cap was at her feet, a little to the left. The countenance was stained with blood, proceeding from the nose and ears. On that part of the cap which corresponded to the left ear, there

* New York Medical and Physical Journal, vol. v. p. 432.

was a bloody spot. So also on the neck-handkerchief, in the same place. The blood was coagulated and still humid. There were no marks of blood on the floor.

The rope, also, was spotted with blood. One was on a part beyond the reach of the hands, and the other on the loose end, and it was observed that to the very extremity of this a gray hair adhered. Indeed, several gray hairs were seen sticking at different parts of the cord.

The body was completely clothed. On the left sleeve, on the back of the left hand, and in front of the petticoat, there were stains of dust, still moist, so much so, that to the latter there were grains of oats and pieces of straw adhering. And it was observed that at a short distance behind, where the body hung, there was a crack in the floor, and in this were seen oats and straw corresponding in appearance to those attached to the petticoat. This spot was also moist.

The right knee of the deceased was covered with a shot of dried dust, but beyond this there were no external marks of wounds or contusions.

Many of these circumstances contradicted the idea of suicide. The female was very aged, and of short stature; the knot was of a kind but little known to females; there were no marks of blood on the hands; the bloody spots observed could not have been made by her, as they were beyond the reach of her arms; while the marks of blood and dust on the dress, and on the left side of the face, indicated violence previous to suspension.

On dissection, Dr. Paris found that the root of the tongue was swollen and ecchymosed, and this ecchymosis extended to the palate. The mucous membrane of the pharynx and the cellular tissue between the os hyoides and the larynx were injected with blood, while the epiglottis at its base was also ecchymosed. Now the cord could scarcely have produced these effects, as it passed below the os hyoides, and not having broken that bone, could not affect the deeper seated parts.

There were also found, on dissection, in front of the clavicle, two ecchymoses, with blood infiltrated into the cellular tissue. No external appearance indicated this, and it was therefore evident that the force producing it must have been of a soft,

yielding nature, like the fingers of the two hands resting on the clavicles.

Dr. Paris, from all these facts, gave it as his opinion that death had been caused by manual strangulation, and that the suspension was subsequently made.

There was considerable testimony involving Buscatel as the murderer, and he was found guilty and sentenced to imprisonment at hard labor for twenty years.*

It is an interesting inquiry, whether proofs of strangulation can be found on the dead body some time after decease or interment. In the instance of a child of eighteen months, first strangled and afterwards thrown into the water, the body, examined ten days after death, was found far gone in putrefaction; but on the fore part of the neck, over the windpipe, was a softish furrow with a hardened ridge both above and below.†

But the most remarkable instance is one that occurred in France. I copy the leading details from a London journal; but the whole case is given in the *Annales d'Hygiène*:—

"In the year 1821, a widow lady of the name of Houet, residing in the City of Paris, disappeared; and certain persons, Bastien, Robert, and Robert's wife, who had taken the house No. 81, Rue de Vaugirard, were suspected of having made away with her. A judicial inquiry was pending ever since in the court of assize; but the accused, for want of evidence, had been set at liberty. Not long ago, however, some information

* *Gazette des Tribunaux*, October 4, 1845.

† Syme's *Justiciary Reports*, p. 266. I add the following in this place, merely as a historical curiosity: "March 16, 1814. On opening a vault at St. Maryport Church, Bristol, the workmen discovered, very deeply concealed, a coffin of great antiquity. It is generally supposed that the corpse it contained was the body of — Yeoman, sheriff of Bristol, in 1643, when the city was surrendered to the parliamentary army by Prince Rupert. Mr. Yeoman was hanged in Wine Street, opposite his own house, by order of Fairfax, for his attachment to the royal cause. The body was in the highest state of preservation, handsomely accoutred in the costume of the day, with gloves similar to those which the sheriffs at present wear. *And there were considerable tumors visible in the neck, which inclined several medical gentlemen, who inspected the body, to be of opinion that they were occasioned by strangulation.*" (*Edinburgh Annual Register*, vol. vii.; *Chronicle*, p. 30.)

was obtained touching a body said to have been buried for about eleven years in a particular garden. An investigation was accordingly set on foot, and by dint of patient and ably directed research, such satisfactory evidence was procured of the identity of the remains, and of the manner of death, that the prisoners were convicted and condemned to the galleys for life.

“The first part of the inquiry—the juridical examination—was conducted by M. Boys de Loury. After excavating different parts of the garden for about five hours, one of the workmen hit upon a hollow spot, in which there were bones. The greatest care was taken to uncover them with the least possible disturbance; they were evidently those of a human body, reduced almost to a perfect skeleton. A drawing was made of the parts *in situ*. The figure reposed on the left side, the head was bent forward on the neck, the vertebral column was curved, the right fore-arm was raised so that the bones of the hand nearly touched that of the face. The pelvis was turned obliquely upward, resting on the haunch, the thigh-bones were raised considerably, and the legs were crossed beneath them. The color of the remains generally was between an ochre and a brown; and when the earthy matter was removed from some of the long bones, the uncovered parts were found to be of deep-red color.

“The grave was four feet deep, funnel shaped, measuring five feet and a half in length at its upper part, but at the bottom, only two and a half; its greatest breadth was about two feet. Some limestone had been placed over the body so as to form a sort of vault. Having made these general observations, the parts were next examined. The skull was small and lengthy in its shape; it seemed, from the position of the head, that the body had been thrown into the grave head foremost. The parietal bones were very yielding, the sutures were well knit, the teeth white, and had been used with care, three molars wanting, and one of the incisors carious. A small quantity of light-colored or ruddy hair was found, having some gray mixed with it.

“The state of the neck was particularly striking; the third, fourth, fifth, and sixth cervical vertebræ, as well as the right

clavicle, were held together by a blackish mass, in the composition of which there could not be recognized any tissue. This mass was surrounded at its lower part by several twists of a cord, two lines in diameter; the cord was in a very decayed condition, and no knot could be found upon it; its direction was exactly horizontal.

"Among the bones of the left hand was found a gold ring, of small diameter, carved in *facettes*; and several small, well-formed finger-nails were also discovered. The pelvis, from its shape and proportions, could only be that of a woman. Some portion of cloth, probably part of a stocking, was found near the legs, but upon exposure to the air it rapidly crumbled to dust.

"Other reporters, MM. Orfila, Marc, Barruel, and Chevalier, were afterwards added to M. Boys de Loury, and three or four elaborate documents were drawn up, of the first of which we give the result.

"From the preceding facts we feel ourselves justified in concluding: 1. That these bones are those of a human skeleton. 2. That the skeleton is that of a female. 3. That this female had attained the age of from sixty to seventy. 4. That her stature was about four feet eight or nine inches (nearly five feet English.) 5. That the hair of the female, which was of a bright blonde color in youth, was mixed with gray at the time of her death. 6. That the hands were small. 7. That during life, the bones had never suffered any injury. 8. That this woman died of strangulation, and that the act was, to all appearance, homicidal. 9. That the body must have lain for several years in the earth.

"The prisoners, who had been long suspected, were at length brought to trial, (nearly twelve years after the murder,) and have been condemned for the remainder of their lives to forced labor. They had a narrow escape of the guillotine; but for some mitigating circumstances which induced the jury to recommend them to mercy, they would have been executed."*

I close this section with a case in which there can scarcely

* Annales d'Hygiène, vol. xi. p. 117; London Medical Gazette.

be a doubt that burning was attempted to conceal the strangulation. It is an additional one to those cited at page 86.

At the Yorkshire assizes, in England, in March, 1842, Jonathan Taylor was tried for the murder of his wife. He had lived on a farm of Lord Wenlock; but four years previous, he formed an illicit connection and left his wife, and the farm was made over by his landlord to his family. He ultimately returned at times, and was, on such occasions, employed in day labor on the farm. On Tuesday, October 26th, all the family left home at nine o'clock, to go to work, but the wife. Early on that morning the husband had also left, saying that he was going to Selby. At twelve o'clock two of the daughters returned home, and then found the wife quite dead, lying upon the hearth near the fire, upon her face, and apparently in a burning state, her clothes being on fire, and *the lower part of her person very considerably burnt. A bunch of keys was found lying under her.* The deceased had been seen to go to a drawer at eight o'clock that morning, to look at some silver (about £3) which she had kept there. She was seen to lock it, and the drawer was found locked; but the money was gone. Lord Wenlock's agreement with the family, and a policy of insurance on the stock were also missing. The keys, therefore, which were found lying under her, must have been used to procure the money at least; and it was remarked, that notwithstanding the fire, they were perfectly bright. The husband had also been accidentally spoken to by a miller in the house, at half-past nine that morning. It was proved that he reached Selby at half-past eleven.

Mr. Anderson found the following appearances, about twenty-nine hours after death: The whole of the head and face, to below the thyroid cartilage of the neck, was much swollen, and of a purple hue, including the ears; the eyes full, prominent, and bloodshot; the mouth closed. Immediately below the swollen part of the neck, there were two dark-brown, crackly, and hard marks across the front part, and extending from these (to the left side especially, and more indistinctly to the right,) were slight indentations formed by pressure. The integuments of the head, particularly of the occiput, were swollen and distended.

The burns extended from the region of the liver on the right side obliquely downward across the abdomen to the left side, which was less injured. They extended some way down the left thigh, and down the right leg to the knee. Both hands were partially closed; the right was severely burned; and the ends of the fingers with loss of substance and black. There were no material burns below the knee. There were some very slight burns on the back part of the right shoulder. There were no vesications containing *liquid* at or near any of the burns, and no swelling or inflammation on their *edges*.

On cutting into the scalp, which was divided from ear to ear, a large quantity of dark and very fluid blood flowed, and the scalp was much darker, and more injected than natural. The portion corresponding to the external swelling was much thickened and injected, with *small coagula* in its substance, and there was some fluid blood between the scalp and skull. On sawing through the skull, the blood flowed still more copiously. When the dura mater was separated from the skull, numerous points of blood issued from each. The brain was highly injected.

The thickened, injected, and swollen part of the scalp on the back of the head, and its separation from the skull, indicated violence during life. This might probably have caused insensibility, but not death. The horizontal marks on the neck, with the external appearances, and those found on dissection, denote *strangulation*. It was found, on cutting into the dark-brown, crackly, and hard marks on the neck, that several small blood-vessels were *inflammatorily* injected, and it is suggested that a hot substance may have passed over these horizontal marks after death, in order to conceal them, and that thus their peculiar condition might be accounted for.

The nature of the burns, and all their attendant circumstances, seem to prove that the body had not moved during the process, and consequently that death must have preceded it.

The jury, without leaving their seats, found the prisoner guilty.*

* *Lancet*, April 25, 1842. A case, probably similar, was tried some years since in New York. It is known as the *Leitga* case, and will be found reported in Dr. Lee's edition of *Guy*.

J. Of persons found suffocated or smothered.

Smothering is the covering of the mouth and nostrils in any way, so as to prevent the free ingress and egress of air. It happens most frequently with children, either as an accident or a crime; and in the former case, from *overlaying* them, as it is called. This occurs from a pillow, bolster, or bedclothes coming in contact with their face in such a manner that their struggles cannot remove it.

In the case of a child six months old, which died from being wrapped up too closely by the parents, who were taking it into the country to nurse, the integuments of the chest, arms, and head were of a dark hue. The mouth was open, and fingers bent; the veins of the heart gorged with blood; the left lung natural, but the right one bright red; the trachea and bronchiæ filled with a reddish froth; the brain turgid, and its vessels in every part, even in the substance, filled, while three drachms of serum were found between the tentorium and cerebellum.*

Adults, in a state of intoxication or debility, may also be destroyed by getting into a posture which prevents the transit of air to the lungs, and then being unable to extricate themselves. Thus Dr. Roget speaks of persons being buried completely under a mass of earth that had fallen upon them, and mentions the following remarkable instance in which life was nearly lost from inattention to the requisites for respiration: "An athletic black, of pugilistic celebrity, had been selected, from the fine form of his chest, and well-marked expression of his muscles, as an academic model. It was wished to obtain a cast of his body, but this being attempted at one operation, and in one entire piece, as soon as the plaster began to set, he felt on a sudden deprived of the power of respiration, and, to add to his misfortune, was cut off from the means of expressing his distress. His situation, however, was fortunately perceived

* London Medical and Physical Journal, December, 1827. A case of inflammation of the lungs in a young infant, mistaken for criminal suffocation, is given in *Annales d'Hygiène*, vol. vii. p. 621.

just in time to save his life by breaking his bonds and releasing him from the extreme peril in which they had placed him.”*

The notorious Burke and Hare, in 1828, killed several persons at Edinburgh, by suffocation. From the testimony of accomplices, it appears that Margery Campbell, while in a state of intoxication, was struck down to a sitting posture on the floor; that Burke threw himself on her, kept her down by the weight of his body, and covering her mouth and nose with one hand, while he applied the other under her chin, held her thus for ten or twelve minutes, till she was dead. The body, examined two days after death, presented the following appearances: The joints flaccid; features composed, red, and rather more turgid than natural; lips dark; conjunctivæ, even in the horizontal position of the body, much injected; a little fluid blood on the left cheek, apparently from the nostrils; tongue not protruded; the scarf-skin under the chin much ruffled, and the surface of the true skin dry and brown when denuded, but without blood or surrounding ecchymosis; the integuments everywhere free from lividity, except on the face; no injury or effusion about the windpipe or cartilages, but the os hyoides and thyroid cartilages farther apart than usual, in consequence of a stretching of their interposed ligament; the internal organs very healthy, particularly the lungs; and the right side of the heart and its veins filled with very fluid black blood.

There were other injuries present, particularly in the spinal canal; but these had been inflicted after death, in consequence of forcibly doubling up the body to inclose it in a box. I have noticed them in a former page.

On the trial, Professor Christison testified, that from the unequivocal marks of violence in the contusions, from the absence of any appearances of natural death, from her being seen alive and in good health a few hours before, and from the blood on the floor where the body lay, the probability of death from violence was strong; but he declined a more positive opinion. In his subsequent remarks on the case, he has well said, that there is a mistaken idea prevalent, that the signs of suffocation are very obvious and characteristic. “It ought to

* *Cyclopedia of Practical Medicine*, vol. i. p. 177.

be distinctly understood by every medical man, that such appearances are very far from being always present." And the reason is manifest, since the mode of procuring death is such as to leave few or any indications, particularly if the murdered person has been previously rendered insensible by opium or alcohol; and in proportion to the rapidity with which death is induced, will be the absence of all external or internal signs. There is no opportunity, says Dr. Roget, for the accumulation of blood in the venous system. The body accordingly will present no discoloration of the skin, no turgescence of the veins, no engorgement of the pulmonary vessels.*

In death by smothering, then, circumstantial evidence must be the principal, if not the only, means of ascertaining whether the event has been produced by crime or by accident.

[I subjoin a most remarkable case of *suicide by suffocation*. Mary Ann Palmer, aged twenty-nine years, was found dead in her sleeping room. The cavities of the head, chest, and abdomen were examined, and a medical certificate that she died of simple apoplexy given. The body was received by Dr. Handyside for public dissection. Twenty-six days afterwards, on attempting to demonstrate the neck, having introduced his finger into the mouth, he found a foreign substance impacted in the posterior fauces so forcibly as to close the larynx and cut off the supply of air. On removing this mass, it was found to consist of portions of soft cotton, called spindle-ends, which were used by deceased in her daily work. The plug was conical, $3\frac{1}{2}$ inches long, $1\frac{5}{8}$ broad at the base, $\frac{3}{4}$ inch at the apex. How strongly does a case like this teach the importance of *thorough post-mortem examination*. Again and again, in season and out of season, let me urge on my young readers, as a duty to themselves as well as to the public, let all autopsies be made so thoroughly that there shall be no possibility of any important change being overlooked.†—C. R. G.]

Death from pressure in a crowd belongs to this division of our subject; but we have not had, until lately, any minute

* Edinburgh Med. and Surg. Journal, vol. xxxi. p. 236; Syme's Justiciary Reports, p. 371.

† Edinburgh Med. and Surg. Journal, vol. lvii. p. 391.

examination of the phenomena occurring. At the Champ de Mars, in Paris, no less than twenty-three persons lost their lives on the 14th of June, 1837, from this cause. There were eleven men and twelve women, and the ages of the sufferers varied from eight to seventy-five. All of them, men and women, died standing, so that more than one corpse was borne along in this attitude by the crowd.

Dr. Ollivier, of Angers, who examined the bodies, states that in all, without exception, the skin of the face and neck was of a uniform violet tint, spotted with blackish ecchymoses. In nine there was infiltration of blood under the conjunctiva; in four there was sero-sanguineous froth running from the mouth and nose; in four, blood flowing from the nostrils; in three, blood flowing from the ears; in seven, fractures of the ribs. In two females the sternum was fractured. There was no mark either of strangulation or wounds, although several bodies bore marks of being trodden under feet after death.

The cause was evidently asphyxia, produced by violent and continued pressure on the chest; and the degree of this may be estimated by the fact that in one-third of the cases the ribs were fractured.

Sixteen bodies were opened. In all the blood was black, diffluent, and filling all the large veins which enter the heart. The pulmonary tissue was mostly of a reddish-brown; and in three-quarters of each lung, posteriorly, there was a considerable accumulation of black and liquid blood, but there was no ecchymosis either on the surface or in the substance of the lungs, except in one case. In all the cases where the conjunctiva was raised by infiltrated blood, and in those where blood had flowed from the ears, the vessels of the pia mater and of the substance of the brain were gorged with blood.*

We must also remember that suffocation may occur without

* *Annales d'Hygiène*, vol. xviii. p. 485; *London Med. Gazette*, vol. xxvi. p. 569; *British Annals of Medicine*, vol. ii. p. 18. "The smothering which is probably most directly fatal, is that which takes place when, in great crowds, children and delicate persons are so crushed by multitudes of human beings, as in theatres, or in cases of alarms of fire, that no time is left to allow the chest to expand." (*Edinburgh Medical and Surgical Journal*, vol. xxxix. p. 398.)

the above extreme circumstances, as in the following instance:—

At the March assizes at Lincoln, Thomas Johnson was indicted for murder. From the evidence, it appeared that the deceased was an aged person, about seventy, living, at the time of the occurrence, with her sister, who was nearly of the same age, in a lonely cottage, a short distance from the village of Croft. On Sunday, the 12th, they were both well and walking about as usual. They slept in the same room up stairs, in separate beds, and retired to rest about eight o'clock. They were disturbed not very long afterwards by a man breaking in at the windows of their chamber. He proceeded to obtain a light by means of a lucifer match, and then, with some muslin, to tie together their hands and feet very tightly, and to fasten their arms under their shoulders, equally tight, to the bedsteads, so that they could not move hand or foot, or at all help themselves. He then tucked the clothes closely over their heads, and proceeded to rob them of some money, silver spoons, etc., and then decamped by the street door, leaving it open and the women in the state just described. This was on Sunday night. They remained in this condition, both being almost suffocated, until the forenoon of Monday, when the deceased, who had been moaning during all this time, and frequently said she must be suffocated, expired. The sister could undertake to mark the time of the death by the cessation of the moaning and the breathing, as being in the course of the forenoon of Monday. She herself remained in this horrible state, almost momentarily expecting the same fate, until Tuesday morning, when she heard some one near, and cried out for help. This was a poor boy begging, who gave the alarm to other persons, and the one sister was found cold and stiff, while the other was extremely exhausted.

The evidence produced left no doubt of the guilt of the prisoner. He was convicted and sentenced to death.*

Dr. Gordon Smith adverts to a mode of suicide said to be common among negroes, viz., swallowing the tongue, so as to close the trachea and produce suffocation.† The possibility

* London Atlas, March 11, 1843.

† Smith p. 231.

of doing this is denied by Dr. Horner,* also by Boyer and Blandin,† yet Dr. Walsh asserts that it is practiced in Brazil, and Mr. Cross‡ says he knew a lad who could swallow the tongue so that it was no longer visible, and that without serious inconvenience. He refers to another case, published on the authority of Magendie.

While on this point, I must not omit noticing a remarkable case mentioned by Dr. Wagner, as occurring in Austria in 1833 :—

“A criminal, who had been shut up alone in a dark dungeon, when visited by his keeper not long after, was found lying dead on the floor. It was thought that he had a fit of apoplexy, and a vein was opened, but to no purpose. It was for the first time noticed that he had a foreign body in his mouth, and it proved to be a piece of woollen cloth two ells long and a quarter broad; a shawl, in fact, which the wretched man had thrust into his throat.”§

It is thus that, in some suspicious cases, tumors pressing on the organs of respiration, or foreign bodies found in the trachea or œsophagus, have explained the accidental or the suicidal cause of death; as, for example, the instance related by Mr. Skae, of a person supposed to have died from intoxication, who was, on dissection, found to have been choked by a piece of meat in the trachea;|| the case of Dr. Handyside, before noted: and the still more remarkable one of Dr. Jackson, where death ensued in fifty-eight days after treatment for a supposed disease of the larynx or trachea, and after death a large iron key was found impacted in the œsophagus.¶

* American Journal Med. Sciences, vol. ii. p. 182.

† Dic. de Méd. et Chir. Prat., art. *Langue*.

‡ Trans. Provincial Med. Association, vol. v.

§ Dr. Cummin, in London Medical Gazette, vol. xiii. p. 973.

|| Edinburgh Med. and Surg. Journal, vol. liv. p. 147.

¶ Ibid., vol. lx. p. 195. Dr. Jackson has another case in vol. lxi. p. 390, where a piece of potato skin was found to have acted as a valve, and thus caused suffocation. Dr. G. N. Burwell (Buffalo Medical Journal, vol. i. p. 36,) relates of a lunatic in the Philadelphia Hospital, who nearly succeeded in destroying himself by pushing three or four dry crackers down his throat.

K. *Of persons found drowned.*

The observations that have been already made on the nature of asphyxia will obviate the necessity of again entering on it, except so far as the phenomena have strict reference to the present cause of death.

Dr. Desgranges, of Lyons, was, I believe, the person who first (in 1790) suggested that there were distinct modes of death in the drowned, and his division has received the sanction of Foderé and Marc.* He was induced to make it from observing turgescence of the countenance in some cases, and paleness in others.

One of the modes he denominates *asphyxia by suffocation*. This cause of death by drowning appears to have been first suggested by the distinguished Cullen. (See his letter to Lord Cathcart, Edinburgh, 1784.) It is probably the most common, and occurs when a person, in full possession of his faculties, is immersed. After ineffectual struggles, water usually enters the trachea and bronchiæ, mixes with the air contained in them, and forms the frothy mucus so commonly perceived. Some water is almost always taken into the stomach; the amount will be greater or less as the individual struggles a longer or shorter time: when little or no effort is made, the quantity of water either in the lungs or stomach may be unappreciable. Respiration is in all these cases arrested more or less promptly, and the ordinary signs of asphyxia will be present, though, as in all other cases, they will vary greatly in degree but not in kind. The individual becomes powerless and insensible, and the body sinks to the bottom of the water.

Another mode of death is termed *nervous or syncopal asphyxia*, and it is well illustrated in a case related by Plater: A female convicted of infanticide was condemned to be drowned. She fainted on being immersed in the water, and remained there a quarter of an hour. On being drawn out, she recovered her

* Marc, p. 165; Foderé, vol. ii. p. 296; Edinburgh Medical and Surgical Journal, vol. xix. p. 620.

senses.* Thus fear, or coldness of the water, or a blow on the head in falling, or absolute intoxication, may suspend, as it were, the vital functions, and throw the nervous system into a state of inaction. [Guy knew this to happen from catalepsy.*] Here, of course, there will be no struggle; and we can only expect to find the marks of simple asphyxia, such as paleness of the face and body, owing to a spasm of the cutaneous vessels, the presence of a little water, but no froth in the trachea, and the internal organs but little differing from their natural state.

Dr. Marc has added a third to these, which he styles *asphyxia from cerebral congestion*, and refers to it such cases as are marked by an apoplectic habit, or where persons fall into the water when in a state of intoxication, or with a full stomach.†

In many instances the first and last are, in his opinion, united; and suffocation and apoplexy, according to circumstances, act reciprocally, either as the essential or aggravating cause of death.‡

In legal medicine, the leading question, in every case of

* Marc, p. 165. This punishment was in compliance with the ancient provisions of the Caroline code. The criminal was put into a sack and sunk in the water. [Did the Turk get his mode of punishing female frailty from so respectable a source as the Caroline code?—C. R. G.]

† We may also add to this, drowning in marshes, or stagnant canals or streams, where deleterious gases are disengaged.

The following is a very apt illustration of this division:—

A female, in full health, was observed to be intoxicated when on the banks of the Schuylkill, and about one hour afterward the body was discovered in very shallow water.

The face was swollen, and of a mottled purple. A small quantity of whitish froth issued from the mouth. On opening the chest and compressing the lungs, an additional discharge of froth followed. The whole pulmonic tissue was engorged and of a dark red. The trachea and bronchial tubes also contained the frothy mucus. The right cavities of the heart and the coronary veins were filled with dark fluid blood. The left cavities were empty. (Dr. Dunglison, in Medical Examiner, vol. viii. p. 169.)

‡ Devergie arranges the modes of death as follows: 1. From asphyxia. 2. Syncope. 3. Cerebral concussion, as when a person falling headlong into the water strikes on a stone or other body, and immediately dies. 4. Apoplexy. 5. A mixed state in which the functions of the brain, heart, and lungs, are suspended nearly at the same time. He allows, however, that the third and fourth are extremely rare, having seen only one case, and even that bore mere presumptive appearances. (Vol. ii. p. 320.)

supposed drowning, is, *Are there any marks that distinguish death by submersion from death previous to submersion?* Or, in other words, was the person thrown when alive, or after death, into the water?

In treating this subject, I shall *first* state the ancient doctrines; *second*, those most commonly received at the present day; and then comment on the different marks, show how far their importance is disputed, and endeavor to fix their proper value. I shall afterwards consider the effects of continued immersion on the dead body, and the changes thus produced. Some medico-legal cases will form a proper conclusion.

I. Ambrose Paré has stated the ancient opinion on the subject as follows: A surgeon will usually find the following appearances on the body of a person who has been thrown into the water while living: The stomach and intestinal canal filled with water; a glairy mucus issuing from the nose, sometimes a bleeding from it; a frothy appearance about the mouth; while the extremities of the fingers will be found excoriated, as if, in dying, they had grasped the sand, or some other hard substance. On the contrary, those who have been thrown, when dead, into the water, will have no tumor of the stomach or abdomen, since all the passages to them were closed by the absence of inspiration; the nose and mouth will present none of the appearances mentioned above, nor will there be any excoriation of the fingers.*

These rules were universally considered orthodox until the commencement of the eighteenth century.

II. The following signs, mostly laid down by Marc, are recognized by the great body of modern physiologists as deserving of peculiar attention. The value attached to each is to be presently mentioned.

Signs that a person has died from drowning.

As to the external appearance of the body,—

1. The eyes are half open; the pupils much dilated; the skin pale from spasm of the cutaneous vessels; the tongue

* Quoted by Foderé, vol. iii. p. 80.

approaches to the under edges of the lips; and these, as well as the nostrils, covered with a frothy mucus. Occasionally when the paleness is wanting, the head will be bloated, the face red, and all the symptoms which denote a determination of blood to the brain will be present.

2. There is excoriation at the end of the fingers, and dirt or sand found under the nails.

As to the appearances on dissection,—

3. A greater or less fullness of the blood-vessels of the brain, according to the violence and length of the struggle.

4. The right side of the heart and its vessels filled with blood; the left either empty or not containing more than half that in the other side.

5. The epiglottis; according to some, is elevated.

6. The diaphragm depressed.

7. The blood in a permanently liquid state, and oozing from the body on the least touch of the scalpel.

8. A bloody, watery froth in the trachea and bronchiæ; to which is added, by late experimenters, the presence of a small quantity of water in the lungs.

9. Water in the stomach.

10. The fullness of the bladder and the reddened state of the viscera.

On the other hand, the *signs that denote death previous to submersion*, are,—

1. The presence of lesions which could not be inflicted under water, such as the marks of ecchymosis, or of a cord around the neck; wounds from fire-arms, or the traces of poisons.

2. The absence of the external characters mentioned above.

3. The absence of water or foreign substances in the trachea and stomach.

4. The lungs being in a state of collapse and not gorged with blood; the abdomen flat, and the diaphragm in a state of natural tension.

5. The blood coagulated.*

In commencing this investigation it is indispensable, if we

* Marc, pp. 172 to 182: Orfila, as hereafter quoted.

wish to arrive at satisfactory conclusions, to ascertain how long the body has remained in the water; how long since it has been drawn from it; whether it has been placed with the face downward or in the usual position, and particularly whether much friction has been used. This last will sometimes produce a state of the skin resembling burns. According to Devergie, if the friction has been carried so far as to excoriate, and the body be left exposed to the air for twenty-four hours, the skin of the parts thus operated on will take the appearance of parchment.

It was doubtless from inattention to these points that so much uncertainty on this important subject once prevailed. The numerical method, however, has done much to resolve all the doubtful points.

III. In proceeding to review the marks of death by submersion, I first remark that singly most of them are of little value; it is only when several are taken together, that a confident opinion can be formed.

I have already explained the supposed causes of the variety in the *external appearance*, and mentioned in what instances paleness is most frequently seen, and when fullness and discoloration.

Possibly, in a majority of instances, if the body be very soon removed from the water, the face and skin generally will be pale. This, at least, is the result of the observations of Dr. Ogston, whose labors on this subject cannot be too much commended.* In the first six cases examined by him within six and a half hours after death, and after short periods of immersion, the surface was pale. So also Mr. Watson, in three cases seen by him, where the bodies were removed after a very few minutes from the water, observed the face to be pale and col-

* Dr. Ogston has applied the numerical method to the cases seen by him, (Edinburgh Medical and Surgical Journal, vol. xlvii. pp. 54, 428.) and I cannot do justice to his researches without presenting a brief tabular view of their leading circumstances. I will confine myself here to the following points: The period of the year at which the drowning occurred; the length of time that the body remained in the water; and the length of time of its subsequent exposure to the air before it was examined by him. I shall then, in the text, refer to each case by its number for its peculiar appearances. Some of them

lapsed. Two of these were suicidal, and the third accidental.* He, however, states explicitly, that in such as die gradually, or after a struggle, the face is livid. In all the remaining cases of Dr. Ogston, there was more or less swelling and discoloration. It is, however, to be recollected that when a body has remained for some days in the water, it changes very rapidly after exposure to the air, particularly if the weather be warm. The features soon become livid and bloated, if not so already, and this alteration extends to all the *exposed* parts. For this reason it is not commonly observed on the back.

Orfila is disposed to ascribe the paleness of the skin to prolonged immersion rather than to the kind of death. He states that in those who have lain long in the water, the integuments of the legs will become indigo-colored, and then brownish on exposure to the air, while the rest of the body is very white; but the moment it also reaches the air, it is successively changed to brown or green, beginning at the chest. Of course, a still longer continuance in the water will, with advancing putrefac-

will also be considered, when noticing the changes characteristic of various periods of continuance in water.

Season.	Time in the Water.	Time in the Air.
1. Summer.....	2 or 3 minutes.	20 minutes.
2. Spring.....	5 do.	20 minutes.
3. Winter.....	3 do.	Half an hour.
4. Summer.....	1 hour.	20 minutes.
5. Autumn.....	4½ do.	Half an hour.
6. Winter.....	6 do.	Half an hour.
7. Summer.....	6 do.	One hour.
8. Winter.....	7 do.	2½ hours.
9. Summer.....	8½ do.	Half an hour.
10. Autumn.....	10 do.	45 minutes.
11. Summer.....	7 do.	8 hours.
12. Spring.....	11 do.	7 hours.
13. Autumn.....	19 do.	Half an hour.
14. Autumn.....	6 do.	39 hours.
15. Summer.....	2 do.	3 days and 2 hours.
16. Autumn.....	80 do.	Half an hour.
17. Summer.....	7 days.	Two hours.
18. Winter.....	27 do.	One hour.

In cases 5, 9, 10, 12, 14, 16, 17, and 18, dissections were made.

* Watson on Homicide, p. 151.

tion, cause abrasions of the skin, which must not be mistaken for the result of injuries.*

But even if the countenance be bloated and livid, we must remember that this is not uncommon from other causes of death. Fothergill suggested, as a characteristic in these instances, (when from drowning,) that the eyes are found half open, and the pupils much dilated; but this last may have been owing to the use of narcotics, and thus death may have preceded drowning. The same remark applies to the other external signs that I have mentioned, as froth at the mouth, protrusion of the tongue, etc. They accompany spasmodic diseases, or they result from other means of violence. If, however, we are satisfied that neither of these causes can have operated, the value of the sign is increased.

There was a marked degree of placidity and *calmness of the features* in every instance witnessed by Dr. Ogston, except where the occurrence of swelling had obliterated all traces of their original expression. In one case, indeed, there was apparently an exception, but on inquiry the person was found to have been very near-sighted during life.

In thirteen cases, Dr. Ogston found the *pupils* were dilated, in only one natural. "The *jaws* were firmly fixed in every instance except one, (where the mouth was open,) and this, both before the commencement of rigidity in the joints of the extremities, and after this had ceased. In nearly every instance the *fingers and thumbs* were semi-bent, indicating that the hands had been convulsively closed during the last struggle, and that the flexor muscles had but partially relaxed after death.

I have mentioned that the *tongue* approaches to the under edge of the lips. This is also confirmed by Dr. Ogston.

Its tip, he observes, is usually met with in accurate contact with the incisor teeth, and in only two cases was it found between the closed jaws, and in both instances, though firmly

* In quoting Orfila, I refer to his *Leçons*, second edition, vol. ii. p. 334. His essay on this subject appeared originally in the *Archives Générales*, and there is a good abstract of it in the *London Medical Repository*, vol. xxviii. p. 541.

compressed, it had escaped injury from that cause. Devergie, however, states that he has seen it wounded by the teeth in several cases.

Froth about the lips and nostrils. Dr. Ogston found this in seven cases out of sixteen, (cases 1, 2, 3, 4, 5, 7, and 11;) of these, it was only remarked once (No. 11) so late as fifteen hours, and in No. 5, probably thirty-two hours after death; while in No. 6 it was not present six hours and a half, and in No. 8 nine hours and a half, after death.

As to the presence of a *frothy mucus in the mouth*, Devergie asserts that this is very common in summer, but rare in winter.* It probably existed in the majority of cases seen by Dr. Ogston.

In four instances, and one of these was drowned in summer, *cutis anserina*, or goose-skin, was observed on parts of the surface.

The *excoriations at the ends of the fingers, and the presence of dirt or sand under the nails*, were formerly much depended upon; and Ambrose Paré and Bohn in particular, relied greatly upon it, since it indicates, according to them, the last efforts of the living individual to save himself from death. Its absence is, however, extremely uncertain as a sign. A man may fall, during a state of intoxication, into the water, and never make an effort to save himself, or he may be in a state of syncope when drowned. In such instances no mark of exertion will be found;† while, on the other hand, a dead body may, from being thrown from a high place, contract this appearance in rolling over. According to Devergie, sand or dirt is found beneath the nails of all that have been for some time in the water. Dr. Ogston did not meet with these appearances in any of the cases examined by him.

[The finding of weeds or dirt grasped in the hands is a very conclusive proof that the individual perished by drowning, provided only the weeds or dirt are such as grow, or are found in the water from which the body is taken. On this subject Taylor well remarks: "If the substance locked in the fingers be of the same character as that at the bottom of the river or

* Devergie, vol. ii. p. 328.

† Mahon, vol. iii. p. 3.

pond, it is difficult to conceive any stronger evidence."* Great care should, however, be taken to identify the sand or weeds with what is found in the water. In a late English case, a strong suspicion of drowning (suicidal) was excited by the fact that weeds were grasped in the hands, till a closer examination showed that the plants were not aquatic; this led to search, and at a place near by, evidence of a struggle was discovered, and there were found plants identical with those in the hands of the dead woman. I regret that I cannot refer to this case; it was published, I think, by Mr. A. Taylor.—C. R. G.]

Slight superficial injuries, as abrasions of the skin, ecchymosis, etc., were met with by the last gentleman in seven cases. In another instance the injuries were more severe, but evidently caused after death.

We come next to the internal appearances.

A greater or less fullness of the blood-vessels of the head, together with the fullness of the right side of the heart, and its vessels, has been much relied upon as a sign by several anatomists. Höpffstock, a physician of Prague, in his dissections of the drowned, observed constantly a great accumulation of blood in cerebral vessels, the jugular veins, the right auricle and ventricle, and pulmonary artery, while, on the contrary, the left side of the heart was completely empty.† Mahon, Kite, and Walter, have confirmed this by their investigations. Goodwyn, however, in his experiments, found the external surface of the brain darker than usual, but its vessels were not turgid. The right ventricle was filled with black blood, but the left, instead of being empty, was noticed by him as being about half filled with blood of the same color.‡ Orfila concurs with this last. Devergie says that the right side is but rarely distended with much blood, although he concedes that generally, but not always, there is more in the right than in the left side.§ Orfila also adds that the right ventricle is of a blackish-brown, while

* Taylor, p. 472.

† Foderé, vol. iii. p. 90.

‡ Enquiry, pp. 4 and 5.

§ Devergie remarks the very striking difference between the two sides of the heart in persons suffocated by carbonic acid gas. There is nothing like this, he adds, in the drowned.

the left is a clear rose-color, and the right cavities retain contractility longer than the left. The brain is not always congested: in syncope cases it would certainly not be so, while in apoplexy and many other forms of death it is very marked. It can therefore have little or no value as a sign of death by drowning.

Dr. Ogston found considerable congestion of the vessels of the head, but very little in the heart and lungs.

According to Detharding, the *epiglottis* is pushed down in the drowned, so as to close the larynx. The correctness of this is totally denied by Orfila and Devergie.

The depression of the diaphragm into the abdomen, with the elevation of the chest, is considered by Hebenstreit as an essential character. He explains its occurrence on the idea that the last act of breathing is inspiration. But Orfila informs us that the result of more than fifty dissections of persons drowned, proved that the last act was not inspiration. At all events, I apprehend that there is little or no variation in the situation of the diaphragm, whatever be the cause of violent death.

The fluidity of the blood was formerly greatly insisted on as an important proof of death by drowning, and it was asserted to have been so seen, even in the vessels which enter the bones.* The value of this test, as a mark of the violent termination of life, has already been noticed. It occurs in many other kinds of violent death, and in some instances of natural decease. While, therefore, its diagnostic character is destroyed, we must allow that it is most commonly found fluid in the drowned; yet even this is not invariable. Lafosse, long since, and Avisard, Orfila, and Devergie, recently, have in a few instances found coagulated blood in the auricles or ventricles of those drowned while living. In five cases of Dr. Ogston, coagulated blood was found in the heart, though the great mass of it was fluid.

It is stated as a remarkable fact, that in dogs drowned, the blood is always coagulated.†

* Marc, p. 179. Thus, says he, if the pericranium be separated, and the blood taken up with a sponge, it will immediately reappear along the surface of the bone.

† Orfila.

The next mark is *the presence of a small quantity of water, very frothy, and sometimes colored with blood, in the trachea and bronchiæ.* This has been a subject of much speculation among physiologists, and formerly the water thus found in the lungs and stomach was supposed to be the cause of death. Becker, a German physician, was the first to controvert this opinion. He published a work at the commencement of the eighteenth century, in which he denied that water was always present in these organs, and illustrated his position by several dissections of the human body, as well as by experiments on animals.* Some distinguished men, as Littré, Senac, and Petit, embraced his views, although toward the end of the last century many physiologists, as Haller, De Haen, and Louis, inclined again to the ancient idea.†

I have already sufficiently explained the commonly received cause of its formation, and must now endeavor to present the results obtained by a host of experimenters.

Weeper, Waldsmidt, Morgagni, and Portal, did not observe it in animals which they drowned. Evers made a number of experiments at Gottingen, in 1753, on cats, and always found it, but could discover none in the bodies of two persons who were drowned when intoxicated.‡ Belloc remarks that he has not found it in cases where persons were undoubtedly drowned while living.§ And he explains this variety, by suggesting that the last act of the drowning person may be either expiration or inspiration. If the latter, a small quantity of water may reach the lungs, and mixing with the air there, form the froth, but probably not in the former case. We shall presently see that this was an approach to what is probably the fact.

On the other hand, Louis drowned animals in colored fluids, and found froth similarly colored in the trachea and bronchiæ.||

* This work is published in the *Novellæ* of Valentini. "J. C. Beckeri, *Paradoxum-Medico-Legale, de submersorum morte sine pota aqua*, 1704," p. 299. See also a notice of this work, in the *Philosophical Transactions*, vol. xxiv. p. 2512. Bohn, of Leipsic, published an essay in 1711, in which he advanced the same opinion. See *Memoirs of Literature*, vol. iv. p. 165.

† De Haen's *Ratio Medendi Continuata*, p. 130, etc.; Louis' *Mémoire sur Les Noyés*.

‡ Foderé, vol. iii. pp. 93, 94.

§ Belloc, p. 178.

|| Kay, p. 242.

Roesler, in forty-five experiments, found in every case a small quantity of frothy mucus at the bifurcation of the trachea. Marc, Mayer of Bonn, Dr. Williams of Liverpool, Devergie, and many others have observed it almost universally.

In order to reconcile this discrepancy, (and noticing the observations of Piorry, that froth would not occur in an animal who, while drowning, was kept permanently below the surface of the water,) Orfila was induced to perform experiments on animals, and found that in every case where the animal came to the surface to breathe, the watery froth was seen in the trachea and bronchiæ. Mr. Taylor's experiments confirm the above results. When the animal was maintained altogether under water, or when it was sunk to a great depth in the river, this appearance was not met with; the trachea was perfectly smooth.* Orfila further ascertained, that if these animals were left for some days in the fluid in which they perished, and then exposed to the air some two or three days before dissection, no trace of froth could be seen. So also with persons found drowned. If the bodies had been in water for a few hours only, it was present; but not so if they had lain twelve or fifteen days, or beyond that period.†

The remarks of Devergie on this sign are so important and interesting, that a full abstract of them is proper.

He thinks observers have not sufficiently insisted on its peculiar physical properties. Froth cannot form without motion, and is the product of an impulse communicated to a fluid and a gas in mutual contact.

The froth of the drowned is commonly of a white color, and consists of numerous very small bubbles, constituting a lather rather than a froth, properly so called. It never adheres to the

* Taylor's Med. Jurisprudence, p. 125.

† Orfila. He objects to the distinction formerly proposed by Foderé, viz., that the froth in question will not appear in *syncopal asphyxia*, or *asphyxia with cerebral congestion*, but only in *asphyxia from suffocation*, on the ground, that in many instances of the former, although death is sudden, yet some water must enter and thus produce it. *Leçons*, vol. ii. p. 344.

He also suggests as a probable reason of its absence in some cases, that the body is drawn by the feet from the water, and left with the head depending for some time before examination. The froth that has been formed may thus flow out with the water contained in the organs.

trachea by mucus, but is in immediate contact with that tube. All the bubbles that form it have a watery envelop, easily broken; and often in opening the trachea, the greater part disappears like soap-bubbles.

Its production is thus evidently the result of vitality. It is also distinguished from similar appearances in the trachea and bronchiæ; in pneumonia, for example, where the *mucus* secreted under the influence of bronchial irritation, is mixed with air in the efforts of coughing.

In both cases, whether from disease or drowning, the frothy matter will be formed more easily in the last bronchial ramifications than in the trachea, since the dimensions of the former being much smaller, are sooner obstructed. And accordingly, Devergie observes, that the existence of froth in the superior part of the trachea is a more certain sign of the life of the individual at the moment of submersion, than when it is met in the extreme branches; but the part where it is preserved for the longest period, is at the bifurcation of the trachea. From his experience, it seems that in winter it can be discovered in most cases during eight or ten days, but after that it completely disappears.

Having thus endeavored to establish its character, and to explain its absence in some cases, it is necessary to add that its presence is not by any means an essential cause of death.* It

* This is well established by the experiments of Dr. Goodwyn. He made an opening into the trachea of a cat, and through this introduced two ounces of water into the lungs. The animal had immediately a difficulty of breathing and a feeble pulse. But these symptoms soon abated, and it lived several hours afterwards without much apparent inconvenience. After this, he strangled it, and found two ounces and a half of water in the lungs. (Enquiry p. 17.) Prof. Mayer confirmed this opinion by numerous experiments. Among other results, he mentions that "animals support a considerable quantity of liquid injected into the lungs, without experiencing mortal symptoms from them. Rabbits can support a dose of four ounces and a half in twenty-four hours. But these injections should be performed by an opening made into the trachea; for if we inject these fluids by the larynx, they excite the most severe symptoms of suffocation, and the animal soon sinks. The suspension of respiration during this irritation of the muscles of the larynx by the injection, is the only cause of death." Again: The symptoms of suffocation, which arise from injections, are not serious when we inject pure water, but they become so when we take thick fluids, which

is also said to accompany other diseases and causes of death. Thus, De Haen mentions having seen it in the body of a person who was hung, and Marc confirms this by a case which he himself examined. In apoplexy, and particularly those cases which arise from an overloaded stomach, it is, according to Chaussier, quite common.* It is probable, however, that the application of the distinctions indicated by Devergie may aid in establishing the nature of the case.

[Not so; for Devergie himself gives a case where this froth was found in the larynx, trachea, and bronchiæ, and he candidly owns that had he not known the contrary, he should have presumed he was examining a case of drowning.† There was also in this case nearly a pint of water in the stomach. Taylor well remarks that such a case shows how cautious we ought to be in expressing a positive opinion in cases of this kind, even when medical proof seems to be conclusive.—C. R. G.]

Intimately connected with this, though I prefer to consider it separately, is the disputed point, whether *water is found in the lungs* of the drowned, and if so, whether it may not have entered after death.

Roesler, in his experiments, found froth, but no water. Dr. Mayer, of Bonn, on the contrary, in his experiments, performed under all possible circumstances, uniformly found it. "He arrived at the conclusion, that in every instance of death by drowning, provided death really arises from the mere obstruction of breathing by the water, and not from apoplexy, or some other affection, occurring at the moment of immersion, water will be found in the lungs. He has made the trial with pure water, with water colored by red-lead or cinnabar, and with a solution of prussiate of potash, which was sought for in the lungs, by the test of the muriate of iron; and in every

obstruct the aerial passages, or some chemical solutions which destroy the parenchyma of the lungs, prevent the oxidation of the blood, and produce extravasations of blood, and inflammation in the lobes of the lungs. The fluids and solutions injected into the lungs are absorbed more or less quickly, according to their nature and degree of concentration. The absorption is in general very rapid, but less in young and newly-born animals than in adults." (Edinburgh Med. and Surgical Journal, vol. xvii. p. 469.)

* Chaussier, p. 45.

† Medical Jurisprudence, vol. i. p. 478.

instance, whether the animal was allowed to rise to the surface or not, whether it was drowned in cold or in warm water, and whatever was the species of animal, he found water, not only in the windpipe and its great ramification, but likewise in the minute bronchial tubes. Sometimes it was found in substance, but more commonly in the form of froth; and he attributes the non-discovery of water, by some experimenters, to their always having expected to find it in substance.*

Piolett, a French military surgeon, drowned dogs, cats, and rabbits in oil, and always found from two to four ounces of that fluid in the air-passages. And he explains the removal of fluid from the lungs in those who recover, on the principle of absorption.†

Dr. Edward Jenner Coxe, of Philadelphia, from a number of well-conducted experiments, makes the following deductions: 1. When an animal is immersed in any fluid, and taken out previous to the last efforts of respiration, none of the fluid will have entered the lungs, while in the stomach will be found one or two ounces. 2. When water is found in the lungs of an animal, it is absolutely necessary that the animal be under water when making its last efforts to breathe.‡

Dr. Ogston observes as follows: "In one case nearly an ounce, and in another six drachms of water were found in the lower part of the trachea, on the surface of which were two or three large air-bubbles. These facts lead us to suspect that writers on asphyxia have underrated the quantities of water which enter the windpipe in death by drowning."§

Orfila and Devergie each state that in many instances they have seen more or less water in the lungs.||

* Edinburgh Medical and Surgical Journal, vol. xxvi. p. 216.

† London Medical Repository, vol. xxv. p. 375.

‡ North American Medical and Surgical Journal, vol. ii. p. 286. Dr. Berger, of Geneva, found that the air remaining in the lungs of drowned persons had lost nearly all its oxygen. (Copland's Dictionary, p. 132.)

§ In two other cases it was attempted to restore life by artificial respiration; and in each a quantity of water escaped in jets from the tube in the trachea.

|| In a remarkable case related by Devergie, the trachea was filled with water, as also the bronchiæ, to their third division; but beyond this, *there was no fluid*. There was no froth. The subject was an infirm female, nearly

Considering this then established by the concurrent testimony of competent experimenters, it remains to ascertain whether fluid will not enter the lungs after death. This is unequivocally asserted by Orfila and Piorry. Dogs, killed by strangulation, were immersed, and, after a short time, water was found in their lungs, the quantity depending on the position of the body. If this was vertical, the fluid was seen even in the extreme bronchial ramifications. And this was distinctly proved with colored fluids, such as ink, Prussian blue, etc. The experiments of Mr. Johnson, of Torrington, also justify such an opinion.* Orfila subsequently repeated the experiment on the human dead body with similar results.

From these facts, he is of course not disposed to attach much value to the presence of water in the lungs as a distinctive mark. The only circumstances that, according to him, render its presence a probable proof of submersion during life, are—1. That the liquid found shall be identical with that in which the person has been drowned. Hence, the presence of any foreign substances, as mud, weeds, gravel, etc., exactly resembling those in the water, is a strong corroborating fact.†

paralytic in her lower extremities. She had been drowned in a bathing-tub; and from her position, it is probable that she swallowed large quantities of water. Most of the common signs of death by drowning were wanting. (Vol. ii. p. 325.)

* Dr. Carson, in commenting on these last, advances the opinion that the water occasionally enters the lungs by imbibition. While under water, the body sustains the weight of a column of fluid; but when removed, the abdomen and chest, being elastic parts, will gradually expand, and the lungs may thus imbibe the fluid that has filled the windpipe and its ramifications. (*Lancet*, vol. xii. p. 139.)

† "Unfortunately," says our author, "it is very difficult to verify this. The presence of sand or gravel is very uncommon; so much so, that in fifty dissections I have observed it but once." (Orfila's *Leçons*, second edition, vol. ii. p. 347.)

The *London Medical and Surgical Journal*, vol. vii. p. 446, mentions a recent German case, reported by Dr. Blumhart: "An individual, subject to epileptic fits, was found dead in a rivulet with his face downward, and the head covered with water, which was not more than a foot deep, and which therefore did not cover more than half his body. On examination, sand and gravel, the largest of which last weighed a drachm, were found in the trachea below its bifurcation into the bronchiæ. Some of the sand, indeed, had entered the pulmonary vesicles. The whole quantity found weighed

2. That the water has not been injected after death. 3. That the body has not remained so long in the water in a perpendicular position, that, by its weight, it may have penetrated into the bronchiæ.

As to the presence of *water in the stomach*, we may remark that it is an accidental circumstance, and in no way connected, as was once supposed, with the cause of death. Goodwyn, Kite, Orfila, and others have proved, by their experiments, that a quantity may be swallowed during the struggles of a drowning person; but there are also cases on record where none was found.

Senac illustrated this subject nearly a hundred years ago, by detailing the method then used in Paris for torturing criminals, and under which the subject occasionally died. The mouth being forcibly kept open with a wedge, and the nostrils closed, a great quantity of water was poured into the person's throat. Respiration was thus prevented, while the irritation of the trachea, in resisting the access of fluid, caused faintings, convulsions, violent agitation of the respiratory organs, rupture of the pulmonary vessels, spitting of blood, and death. But *very little water entered either into the lungs or the stomach* of these unfortunate persons. On dissection, however, the usual lesions observed in death from asphyxia were apparent.*

between three and four drachms. The size of one of the stones, which exceeded the capacity of the glottis, proves that it could not have entered the trachea by a mere mechanical descent after death, but renders it probable that it was swallowed in the last moments of agony."

A similar case, except that mud was found instead of gravel, occurred to Devergie. The individual had been drowned in a ditch. (Vol. ii. p. 333.)

In one instance, our author found a portion of the contents of the stomach in the trachea. The individual had been drawn living from the water, but expired shortly after. Devergie supposes that vomiting may occur occasionally in the drowning, and in this particular case an effort at inspiration carried the food into the respiratory passage. (Page 337.)

* Smith, p. 210. It was formerly thought that if no water was found in the stomach or bronchiæ, death could not have been occasioned by drowning. (See the subsequent notice of the trial of Spencer Cowper.)

"The common people, who in all countries inherit the cast-off prejudices and opinions of their betters, are still of the same opinion; and deeming water in the stomach and lungs the symptom most to be dreaded in cases of

"Water was observed," says Ogston, "in the stomach in five cases out of seven. In case 16, its presence was hardly to be expected. In cases 9, 10, and 14, its presence was also detected in the œsophagus, while in several cases which were not examined, its escape from the mouth, on turning the bodies or on pressing the abdomen, proved its existence in the stomach or œsophagus."

While, then, water may be found in the stomachs of those who have been drowned, it becomes a question of some interest whether it can enter after death. Experiments, so far as they have yet proceeded, are decidedly opposed to this. Goodwyn and Kite never found any in the *intestines* of animals; and Dr. Fine, of Geneva, has ascertained that it cannot be introduced into the stomachs of the dead, except by passing an elastic sound into the œsophagus. The sides of that canal, when in a state of inaction, appear to be in close contact.* These results are confirmed by Orfila and Marc. Dr. Edward Coxe also found that when an animal is killed, and then immersed for twelve or fourteen hours, the stomach will not contain any of the fluid.† Devergie remarks that the quantity found varies, but he has noticed it from a pint to a quart; and he adds that it is a phenomenon indicating the presence of life when it occurred, since deglutition is necessary to produce it.

The experiments of Mr. Taylor also lead to a similar conclusion. He found that when an animal was stunned prior to

drowning, the first indication of cure, therefore, when such an accident occurs, must be to remove it as speedily as possible. Accordingly, when a man is found drowned, the first process adopted is to roll him about on a barrel to dislodge the fluid, which they look upon as the *origo mali*, from all its creeks and corners; and then to hang him up by the heels to empty it out, as if the human frame were as simple in its construction as a bucket. The Humane Society, some years ago, did a good deal of mischief by giving their sanction, in a pamphlet on the means of restoring suspended animation, to the antiquated process of throwing tobacco smoke up the rectum, etc." (DEXLOR.)

* Marc, p. 160.

† Dr. Darwall, in a note, after quoting Dr. Coxe's experiments, showing that ink was found in the lungs of a cat immersed after death, but not in the stomach, observes that "it is clear that the principal dependence ought to be placed upon the presence of fluid in the stomach, and not in the lungs."

submersion, water did not pass down the œsophagus. But he also, in repeated dissections of drowned cats, discovered no water in the stomach. "They had been invariably kept under water from the first moment of their submersion, and thus in a condition but little favorable to the exercise of deglutition." It is hence probable that the quantity found in the stomach will be greater, if the subject comes frequently to the surface and respires.*

The presence of water in the stomach is deemed by Orfila to be the most satisfactory proof we have of drowning during life, provided the water is identified with that out of which the corpse has been taken, and if it be proved that it has not been swallowed during life or injected after death. If, however, putrefaction has advanced to any extent, water may enter; and Mr. Taylor has shown that if a body be sunk to a very great depth in water, this fluid will find its way into the stomach and alimentary canal, by virtue of its columnar pressure. Of three cats, one was rapidly lowered to the depth of fifty feet in the Thames, the second to the depth of two feet, and forcibly maintained in that position, while the third was allowed to sink and rise to respire frequently before death. All were removed from the water after a quarter of an hour. The stomach of the first was completely distended with water, in that of the second there was little or none, while the stomach of the third was filled, but not to so great an extent as that of the first.

From these experiments, Mr. Taylor, although attaching great importance to this sign, thinks it should be first considered whether, in the case of the submersion of a dead body, the water may not have entered the stomach from the effects of putrefaction, from the body having been sunk to a great depth, or from the water having been artificially injected. And again, whether the water has not been drunk by the deceased before death. If he can satisfy himself that none of these circumstances have operated, the medical jurist is justified in attaching great importance to this as a sign of drowning during life.

* Taylor's Medical Jurisprudence, p. 120.

But it will be asked, is its absence a proof to the contrary? Apart from the fact that it has not been found in many undoubted cases of drowning, it must be recollected that syncope in numerous cases may have occurred at the moment, and thus the power of deglutition have been lost. There is no doubt, also, that the common practice of carrying the bodies of persons drowned, with the head downward, will cause the water to drain away; and lastly, in these instances where the body has been exposed and putrefaction is advancing, the fluid may have transuded through the parietes of the stomach, and become gradually lost by evaporation.*

Some observers have been disposed to attach value to the state of the bladder. Piorry remarks that in all sudden deaths, this viscus is empty, while he found it full in dogs which he drowned.† He adds, however, that this fullness disappeared as the body became rigid. Devergie found it to occur in some instances in the human body, and in others not. He has more frequently observed the urine tinged with blood. In some instances it was of a rose color, and in others quite red.‡ In four of the eight cases of Dr. Ogston, the bladder was empty and contracted; in one it was half full; in one it contained two ounces of a milky fluid, and in the remainder its condition is not mentioned.

The viscera and the intestinal canal are frequently seen high colored in the drowned. Dr. Carson indeed remarks, that the lungs particularly will sometimes bear almost the appearance of inflammation; and Orfila said that when drowning took place while the process of digestion was going on, the mucous membrane of the stomach had a red or violet tinge. It is important to remember this in cases where suspicion of poisoning exists.§

* Taylor's Med. Jurisprudence, pp. 121-124.

† London Med. Repository, vol. xxviii. p. 542.

‡ Devergie, vol. ii. p. 339.

§ In a late dissection of a person drowned in a pond in London, where the body remained immersed during half an hour, and the examination was made the next day, the lungs were of a deep and livid hue, and crepitated very indistinctly. They were filled with a frothy, sanguineous fluid, and the bronchial tubes and air-cells contained a quantity of mucus and water. The

From this tedious but necessary review, it will be seen that hardly any single proof, taken separately, is perfectly satisfactory, and that several must be united in order to arrive at a just conclusion. It is evident that the presence of froth in the ramifications of the bronchiæ, and of water in the stomach, [and of weeds grasped in the hands,] are the most diagnostic. In the absence of any marks of violence, several others that I have mentioned may be considered as important supplementary proofs of drowning during life. Some of the conditions imposed by Orfila can hardly be obtained on a medico-legal inquest, and Devergie indeed accuses him of having given opinions in contravention, or rather in neglect of his own rules. It is the union of most of the signs on which we have commented, that must be relied on.

Within what period do the signs of death by drowning disappear? This question is thus answered by Devergie: In winter they are manifest although the body has lain from fifteen to even eighteen days in the water; in summer, from the third to, possibly, the sixth or eighth day of immersion. Exposure to the air, after the body is taken from the water, quickly dissipates them, particularly in summer. The progress of putrefaction is then so rapid that a very few hours are sufficient to effect this. [Yet in the disgraceful medical testimony in the case of Spencer Cowper, (see *postea*,) the opinions given were based on an examination made *six weeks* after death, the body having been in the water only a few hours.—C. R. G.] The reason will be manifest, when we recollect that, with the exception of dirt under the nails, hardly any other is permanent. The color of the face changes, the redness of the larynx and trachea may be mistaken for a pseudo-morbid appearance—gas forming in the lungs may drive off the tracheal froth, and the water in the lungs and stomach will be dissipated by the changes in those organs.*

As to the marks of violence which may be found on the

face, neck, and chest were of a dark livid hue. Several of the internal parts were in a state of vascular engorgement. (London Medical and Surgical Journal, vol. vi. p. 798.)

* Devergie, vol. ii. p. 348.

bodies of the drowned, they are with great propriety divided by Foderé into three classes.

1. Those which are totally independent of any connection with the circumstance of drowning. Of this nature, are the usual signs of poisoning, a regularly formed ecchymosis around the neck, indicative of strangling, or wounds inflicted by fire-arms or cutting instruments. All these lesions have an essentially distinct character. And hence the evident importance of examining all bodies drawn from the water. It was by pursuing such an investigation, that Deveau discovered, under the breast of a woman, a wound which had penetrated to her heart.

In a small village in Warwickshire, a young gentleman suddenly disappeared on the evening previous to his intended marriage. Seven days after, his body was found floating in a neighboring mill-stream. The idea prevailed that this was a case of suicide, although no cause for it could be assigned. A surgeon, however, found some suspicious marks upon the throat, and finally gave it as his opinion that the deceased had died from strangulation. Suspicion now fell on a man of bad character, who had been seen on the evening in question running in great haste from the direction of the spot in which the body was subsequently found. He was apprehended, but as no satisfactory proof of guilt could be elicited, he was discharged. Ten years afterwards he was convicted of sheep-stealing, and sentenced to be transported. While on board of the hulks, he made a voluntary confession of having destroyed the deceased, and was subsequently tried entirely on his own evidence.

He had been engaged in stealing potatoes from the garden of the deceased, was detected by him, and failed in escaping. The prisoner attempted to leap the mill-stream, but the bank on the other side giving way, he fell into the water. The deceased plunged after him, and a struggle ensued. After being nearly overpowered, the prisoner succeeded in overturning his antagonist, and seizing him by the throat, held him fast in this manner under water until he seemed to have no more power. The escape was then effected in the manner already described.

The judge gave it as his opinion that the case amounted

only to excusable homicide, and accordingly the man was acquitted.*

Again, the following case is related by Mr. Watson: "Archibald McLennan was tried at Inverness, September, 1830, for the murder of his wife, by having bruised and strangled her, and afterwards thrown her body into the sea. When the body was inspected, several wounds and contusions were found on different parts of the head. At one of these, which had been inflicted by a blunt instrument on the crown of the head, there was a considerable effusion of dark-colored blood between the scalp and the skull. There were several livid spots on each side of the throat, giving it the appearance of having been forcibly grasped by the fingers of another person. Abrasions of the cuticle under the chin, at the angle of the jaw, and on each side of the neck, were also present. There were also marks of contusions on the right side of the abdomen, and on several parts of the arms and legs. No examination seems to have been made of the internal parts." The guilt of the prisoner was thought by the judge to be clearly established by circumstantial evidence confirming the medical opinion. But the jury considered the case not proven.†

2. There are marks of violence which may have resulted either from accidents attending submersion or from previous homicide, and these are unequal, irregular wounds, which do not penetrate far into the body; contusions, fractures, and luxations.‡ In all such instances ascertain, if possible, the

* Smith's Forensic Medicine, second edition, p. 242.

† Watson on Homicide, p. 129.

‡ A case probably belonging to this division is given by Ollivier, of Angers, (*Annales d'Hygiène*, vol. xxii. p. 195). The body of a female was taken from the water eight days after her absence from home. There was a slight wound on the top of the head, and some contusions near it. The body was, in the opinion of the first examiners, ecchymosed in various places, but our author shows that this was rather the result of immersion, and subsequent exposure to the air. On the whole, there were not facts sufficient to inculcate the suspected person. Dr. Ollivier mentions the following, which is worthy of remembrance: The prolonged immersion in alcohol of ecchymosed tissues does not remove the blood which has penetrated through them during life, but the color remains permanent. On the other hand, a sanguineous infiltration resulting from post-mortem imbibition is speedily dissipated, and leaves the tissue of its original color.

height from which the person has fallen, and the resistance he may have encountered.* The rapidity of the current, and the sharpness of the banks, may also have caused wounds. The obstacles which might have been encountered should also be noticed. Dr. Fine remarks that the rapidity of the Rhone, and the numerous mills erected on its banks, often produce most shocking wounds on the bodies of those who are driven against the stakes in the stream, or are drawn into the machinery.†

3. Lastly, there may be lesions received after death. These are to be determined by the rules laid down in the section on medico-legal dissection. The progress of putrefaction deserves particular attention in this case.

Even after every attention to these directions, and after the most laborious research, the medical witness will occasionally be extremely perplexed in deciding on the nature of injuries. A case of this description is mentioned by a late writer. The body was found after it had remained nineteen days in the water. On the temple there was a red patch, from which several lines radiated as if a blow had been inflicted on the part with a blunt instrument. There was a red line extending about three-fourths around the neck, of a finger's breadth behind, but connected with a patch of redness nearly three inches wide in the forehead. The medical witness supposed that these might have been caused by pressure during life. Between the pericranium and the bone there was a patch of

* "A few years ago, a man who had leaped from each of the then three bridges of the Thames with impunity, undertook to repeat the exploit for a wager. Having jumped from London Bridge, he sunk, and was drowned. When the body was found, it appeared that he had gone down with the arms in the horizontal, instead of the perpendicular posture, in consequence of which both of them were dislocated by the fall upon the water." (Smith, p. 214.)

In another case, a soldier, an excellent swimmer, plunged headlong into the Sambre. He was seen to struggle, but it was supposed to be in jest; but perceiving him to become motionless, he was dragged out. On recovering his senses, he was found to be perfectly paralyzed from the neck downward. Death followed in a few hours, and on dissection the body of the fifth cervical vertebra was found fractured transversely. Case by Dr. Reveillon. *Archives G n rales*. (Medico-Chirurgical Review, vol. xi. p. 240.)

† Marc, p. 183.

extravasated blood of the size of a shilling, and the brain was gorged with blood. No water was discovered either in the trachea, lungs, or stomach.

On cross-examination, the witness allowed that some of the marks might have been caused by decomposition, but he inclined to the idea that violence had been inflicted during life, although he considered it improbable that the wound on the forehead should have produced death.

Another surgeon stated that, with the exception of the mark on the head, he had seen all the appearances met with on the deceased in a man who had certainly been drowned. If the deceased had fallen accidentally into the river, and had struck in the descent, all these appearances might have been produced. It was further shown that the individual, when last seen, was intoxicated, and that the bank of the river was such that he might readily have slipped off.

Amid this conflict of opinion, and with the admission, by the witness for the crown, as to the wound on the forehead, the prisoners might have escaped, had not strong circumstantial evidence, and the confession of a female, who was in the house at the time of the murder, led to their conviction and execution.*

The following are still more striking cases: A prisoner, while escorted by a party of soldiers along the banks of the Po, took an opportunity of throwing himself into the river for the purpose of escaping. His arms were at the time bound together. Thirty-three days after, the body was discovered. Besides the ordinary signs of drowning in the respiratory organs, there was a livid circle extending completely around the neck, about a line and a half wide, and immediately below it another mark, lighter in color. The skin over the trachea

* Taylor's Medical Jurisprudence, p. 134. Case of Pugh, Williams, and Matthews, for the murder of Walter Carwardine. Poirroux (p. 134) relates an equally interesting case, in which the medical witnesses were much in doubt whether the injuries noticed (wounds and fractures) might not have been produced by the large and sharp stones which constituted the bed of the torrent. In process of time, however, it was ascertained that the murdered man had been robbed, and the double felon, after being arrested and committed to prison, destroyed himself.

was ecchymosed. Blood was extravasated in the brain, and between its membranes. The presence of the marks, which some supposed to have originated from strangulation, was explained by the fact that the deceased had worn a thick, coarse shirt, tightly buttoned around the neck. The water, by the imbibition, caused a retraction of the stuff, and thus made the shirt-collar act as a tight ligature. Barzellotti and Orfila gave it as their opinion that this was a case of drowning, and the persons accused of strangling were set at liberty.

Again, a female was accidentally drowned in England. The body was not more than ten minutes in the water, and a deep livid mark was immediately seen around the neck. This was found, by careful examination, to have been produced by the string of a cloak which the deceased wore at the time of the accident. It arose, probably, from her struggling in one direction, while the tide was drifting the cloak in another.*

IV. The next point proposed for consideration, was the effects of immersion on the dead body.

There is but little difference between the specific gravity of the human body and that of water, though the former is somewhat the greater. Hence a person, whether dead or alive, when thrown into the water, will sink, unless buoyed up by external aid; but after the process of putrefaction has occasioned the evolution of gaseous matter, the body becomes specifically lighter than the water, and it rises to the surface. It is for this reason that bodies committed to the deep have generally weights affixed to them.†

It is, however, possible that a body may float at first, when its cavities have been previously filled with air. Thus Dr. Male supposes, that in the case of a person strangled and thrown into the water with the cord attached around the neck, the body might float at once, from the included air. It is also the opinion that dead bodies will float sooner in deep than in

* British and Foreign Medical Review, vol. ix. p. 49.

† Captain Maryatt mentions in his Diary, that the noted land-pirate and murderer, Murell, when he concealed the bodies of his victims in the water, first took out the intestines. The object of this was to prevent them floating through the evolution of gas.

shallow, and in fresh than in salt water.* In the disastrous accident of the *Royal George*, the bodies were observed to rise to the surface on or about the fifth day.†

* Male, second edition, p. 115. The body of Prince Carraccioli, who was hung by order of Lord Nelson, was sunk into the sea with double-headed shot, weighing 250 pounds, tied to the legs. It floated on the surface in thirteen days. [Surely this is unjust to the memory of Nelson. Carraccioli was a Neapolitan admiral, was tried by a Neapolitan court-martial, and condemned as a traitor. The worst that can be said of Nelson, with any shadow of justice, is, that he did not interfere to save the life of Carraccioli. But neither did Wellington interfere to save Ney, who was executed under precisely the same circumstances. Yet nobody talks of Ney's being shot by order of Lord Wellington.—C. R. G.]

† Paris, vol. ii. p. 41. The question, whether there is any fixed point of time at which the bodies of the drowned rise to the surface, was fully discussed in the case of *Vollan and Adams v. The National Loan Fund Life Assurance Company*. The defendants had given a policy on the life of one Shoemaker, for \$10,000. It was alleged that Shoemaker was drowned on the Hudson River, September fourth, and that the body was found floating September seventh. The defendants denied that the body was that of Shoemaker, alleging, among other things, that bodies of persons drowned did not float so soon. On this point Dr. B. P. Staats testified that, from his reading, he thought a body would not float under from seven to ten days. Dr. B. Budd, assistant coroner in New York, had seen as many as one hundred and fifty cases of drowning; never knew a body to rise in less than six days.

Dr. Seth Geer; was coroner of New York for eighteen months: had examined between three and four hundred bodies of persons drowned. He found by experience, that bodies would rise in summer in from eight to ten days. A Blakeley; was deputy coroner for more than two years. Drowned bodies would rise in summer, on the average, in from six to ten days. On the other side,—

H. C. Van Urie; was coroner of Albany for four years. Has known two or three instances where bodies floated in three or four days.

H. C. Allen; had been coroner of Albany for twelve or fourteen years. Believes there is no definite time at which bodies will rise. Knew of an instance of a girl of fourteen years, drowned on Friday, at 12 m., floated on Sunday, at 12 m. Knew of a man named Moreton, whose body floated on the fourth or fifth day.

G. E. Cutler; was coroner of Jersey City; knew of a case of a young man who was drowned on Sunday, between eight and nine o'clock, whose body floated on Tuesday or Wednesday, at 11 a. m. J. Osborn; was coroner of Albany county for three years. Had known bodies come up in two days. One, an Irish girl, floated after two or three days. S. M. Berton, acting coroner of New Haven for three years; knew a case where a person whom he saw on Friday, who was missed on Saturday, and whose body was found floating on Sunday. Communicated to Dr. Beck, by Hon. Judge Wright, who

It often becomes a subject of much importance to ascertain *how long the body has lain in the water*. Until recently, we have had but few facts to guide the medico-legal examiner, and his inferences could only be drawn from the general results of putrefaction. It is now known that the body, after lying for some time under water, becomes partly converted into a saponaceous substance termed *adipocire*, in appearance resembling spermaceti.* Water in any situation will produce this change, although running water has been found to do it more rapidly. The question, how long a time is necessary to cause this change to take place, has been made the subject of legal inquiry.

"At the Lent assizes, held at Warwick, in the year 1805, the following case came before the court: A gentleman named Meecham, who was insolvent, left his own house with the intention (as was presumed from his recent conduct and conversation) of destroying himself. Five weeks and four days after that period, his body was found floating down a river three miles from Birmingham, the place where he resided. The face was disfigured by putrefaction, and the hair separated from the scalp by the slightest pull; but the other parts of the body were firm and white, without any putrefactive appearance. The clothes were unaltered, but the linen was exceedingly rotten. On examining the body, it was found that the lower part of the abdomen and the glutei muscles were converted into adipocire.

"A commission of bankruptcy having been taken out against the deceased a few days after he left home, it was important to the interest of his family to ascertain whether or not he was living at that period. From the changes which the body had sustained, it was presumed that he had drowned himself on the day he left home, and to corroborate this presumption, Dr.

tried the case. The jury gave a verdict in favor of defendant. There was other testimony strongly supporting the idea that the body which floated was that of Shoemaker.

* See Dr. Gibbs' papers on Adipocire, in Philosophical Transactions, vol. lxxxiv. p. 169; vol. lxxxv. p. 239. "This appearance is often to be found in the macerating tub of a dissecting-room, where there is but little water, and that both stagnant and seldom changed; but the process of its formation requires a much longer time to effect than elsewhere." (DARWALL.)

Gibbes, of Bath, stated on the trial that he had procured a small quantity of this substance by immersing the muscular parts of animals in water for a month, and that it requires five or six weeks to make it in any large quantity. Upon this evidence, the jury were of opinion that the deceased was not alive at the time the commission was taken out, and the bankruptcy was accordingly superseded."* We shall presently see that later observers have fixed a longer period for the production of this change.

I have alluded to recent observations and discoveries in this division of our subject. These are principally derived from the writings of Devergie, published first in the *Annales d'Hygiène*, and subsequently in his treatise on Legal Medicine. His opportunities have been most favorable. "He was authorized to carry on his investigations at the establishment called 'La Morgue,' in Paris, a building on the banks of the Seine, to which are transported all bodies found dead in the city and its environs, and where they are exposed during three days for the purpose of recognition by their friends. The number thus exhibited exceeds three hundred annually, and includes all manner of violent deaths. In case of the sudden disappearance of an individual, his friends repair to the Morgue, and leave with the porter an accurate description of his person, his clothes, and the period at which he was last seen; and when a body is brought in, it is carefully examined, and if it corresponds with any of the descriptions that have been left, notice to that effect is sent to the persons interested, who come and claim it. The number of persons recognized is very considerable; in the first six months of the year 1829, out of 148 bodies, 116 were

* Male, second edition, p. 192. Professor Amos' Lecture, in *London Medical Gazette*, vol. viii. p. 193. Dr. Harlan, of Philadelphia, placed a cranium for maceration in a barrel half filled with water and closely covered over. On examination at six weeks after, he found it floating on the surface of the water with one side above the surface, and on cutting into it, the whole substance down to the bone was converted into adipocire. On the contrary, that portion of the head and face which was immersed was found putrid and macerated. (*North American Medical and Surgical Journal*, vol. v. p. 471.) I neglected to mention, in a previous page, that Dr. Bostock considers adipocire as the immediate production of the muscular fibre, and not, as some have thought, a mere residue of the fat after the destruction of the muscles. (*Medico-Chirur. Transactions*, vol. xv. p. 159.)

claimed; of this number, 62 were drowned, of whom 45 were recognized. Being thus furnished with positive information as to the time of immersion and that of finding the body, Devergie was enabled to prosecute his inquiries with great accuracy."*

I shall bring together, in this place, the principal observations of our author on the *changes induced by the immersion of a body in water, and the progress of putrefaction in it*, premising, however, that the correctness of some of his statements have been already questioned, and particularly by Dr. Ogston. The variations noticed by this gentleman will be subsequently mentioned.

Putrefaction always occurs later in water than in the air. It advances most rapidly when the water has a temperature of from 18° to 25° of Reaumur, (72° to 88° of Fahrenheit.) It is difficult to say whether it occurs earliest in running or stagnant water. The experiments of Orfila show that saponification, the formation of adipocire, happens earliest in the former, but Devergie, while he concedes this, inclines to believe that decomposition (the development of gas and reducing to *putrilage*) occurs more rapidly in the latter. In the water of sewers, putrefaction is still longer delayed than in either of the above, but saponification is an early result.

Devergie arranges the phenomena of the putrefactive process in water under nine distinct heads. They do not, however, always occur in succession, as frequently two or more are seen on the same body.

1. *Green putrefaction.* This commences in the skin of the sternum, and extends regularly to that of the face, neck, abdomen, shoulders, groins, arms, and legs. In atmospheric putrefaction the order is different. Here the abdomen is first attacked, then in succession the groins, the inferior regions of the chest, thighs, anterior part of the chest, legs, neck, arms, and face.†

* Dr. Beatty, in *Cyclopedia of Practical Medicine*, art. *Persons found dead*.

† This is true *very generally*, but Dr. Chowne mentions a striking exception in the case of a man who died in the street and was brought to the Charing Cross Hospital, London. At the end of eight days the green putrefaction had extended to the shoulders, neck, face, and limbs, but the umbilicus and anterior surface of the abdomen were still of a natural color. (*Lancet*, N. S., vol. xxiv. p. 823.)

The green color is at first light, but gradually becomes darker. It sometimes extends from the skin to the superficial muscles, but rarely, unless in summer, to the deeper seated. It is either uniform or traversed by dark-blue or black lines, caused by the decomposition of blood in the vessels. This change occurs about the third day in summer, and from the twelfth to the fifteenth in winter.

2. *Evolution of gas.* The seats of this are the stomach, intestines, lungs, and cavities of the heart. In winter it is far from being as marked as in summer. The heart, indeed, in the former season, is generally empty. But when the gas is extensively evolved, it frequently drives the blood from the larger vessels into the superficial veins and the capillaries, so as to give a red appearance to the cellular tissue and the mucous membrane of the abdominal organs and trachea. This color is most marked in the cavities of the heart when considerable blood has remained in the ventricles at the moment of death, and accordingly, from its intensity, we may form some opinion as to the cause producing death, whether asphyxial, syncopal, or apoplectic. It is these appearances which have been mistaken in the intestines of the drowned for gastro-enteritis. When developed in the lungs, this gas expels the froth from the trachea. It is disengaged in summer from the fourth to the sixth day, and in winter from six to eight weeks. In the former cases it is produced very rapidly, occupies the subcutaneous cellular tissue, and greatly enlarges the size of the body. Hence bodies come to the surface and float much earlier in warm than in cold weather.

3. *Brown putrefaction.* Commences in the same parts as the green, but does not spread so extensively, being often overtaken by saponification. It seems to be limited to the skin. Occasionally there is a variety of colors on the same body, green, yellow, or violet. The brown color is accompanied with softening of the tissues. It occurs at the end of the month in winter, and from ten to twelve days in summer.

4. *Putrilage.* The parts attacked by the green and brown putrefaction are reduced to a putrid matter, which dissolves in water. It commences on the skin of the forehead, and extends in succession to that of the eyelids, nose, lips, clavicles, sternum,

cartilages of the ribs, the abdomen, and groins. The destruction of the skin allows the gas to escape, although this has many natural outlets. The period of this change is variable, but generally from the second to the third month.

5. *Saponification.* Such parts of the skin as have not been destroyed become opaline, dense, and unctuous. The progress of liquefaction is arrested, and the parts affected by it take on hard and dry edges. The muscles shrink and assume a rosy color. The bones, if exposed, are of a bright red. All the internal organs diminish in bulk. The stomach, intestines, and bladder are of a white color. This change occurs earliest in fat females, but usually it is present from the third to the fourth month. Frequently along with this the skin of the legs becomes dense and of a yellow color, resembling parchment.

6. *Drying.* All the fluids seem to be removed, and the hard parts acquire such solidity as to retain within their coverings the putrid matter into which they have been converted. Saponification goes on during this change, and has penetrated into the intermuscular cellular tissue. The muscles alone escape drying; they are red, moist, glistening, and yet not easily torn. Begins about the fourth month.

7. *Corrosions.* The cellular tissue appears as if corroded, and these corrosions present a granular surface. They are always a result of saponification, and if developed on a part which has only undergone this, they are round, and of small size, but if they occur on places previously attacked with the various kinds of putrefaction, they are irregular and large. This change occurs at four and a half months.

8. *Incrustations.* These consist of a calcareous soap, produced by a double decomposition of the sulphate and carbonate of lime in the water, and the margarate and oleate of ammonia in the adipocire. The skin is thickened, so that it is sonorous when struck. The bulbs of the hair also enlarge. These phenomena only occur on the parts not resting on the bottom of the water. About this period, also, the muscles become saponified; the brain, also, and the bones are extremely friable. The cartilages of the trachea are separated, and the stomach and intestines are nearly destroyed. Period, from four to four and a half months.

9. *Destruction of the soft parts.* The saponaceous matter separates from the bones, and disappears. It commences on the head, and afterwards upon the chest, abdomen, and extremities.

Dr. Devergie next adverts to the circumstances which modify the putrefactive process in water. Among these are—1. The extent of dress on the body. Any part that is thus protected from the contact of the water will be the slowest in putrefying. Hence, boots in men, and corsets in females, are a great protection. Thus in the body of a female, which had been five and a half months in the water, the skin of the trunk was in a natural state, while that of the head was saponified, and upon the thighs and legs it was covered with calcareous incrustations. 2. Stagnant water accelerates those stages of putrefaction which he styles green, brown, and liquid. 3. The changes above detailed do not necessarily observe a certain order of sequence; they may, however, be grouped into two classes, mutually independent: the one comprehending green, brown, liquid, and gaseous putrefaction; and the other, saponification, corrosion, drying, and incrustations. The former always affect the same parts, but may be wanting in some instances, when saponification supplies their place. Our author, however, has never seen a case of entire saponification without any liquid putrefaction. 4. The development of the various kinds of putrefaction renders the body more disposed to float. In summer bodies do not remain in the water more than from two to three weeks. 5. It is doubtful whether the development of gas is a constant phenomenon. In winter it is possible that there is scarcely any. Certainly it is produced much more slowly. 6. There is at least a month's difference between the progress of putrefaction in summer and in winter. 7. It is very rare that saponification occurs in rivers during summer. This change is prevented by the rapid induction of putrefaction, which causes the body to float. If this last does not happen at the ordinary time stated above, we have reason to believe that the body is retained in the water by some substance keeping it down. Under such circumstances a saponification may occur. 8. Saponification is prevented when a portion of the body is deprived of its skin. 9. Saponification,

drying, etc. occur more readily in young persons and those who are fat.

In explanation of the fact already stated, that in the water of privies putrefaction is less rapid than in running water, while saponification occurs earlier, M. Devergie suggests that the presence of a large quantity of ammonia may delay the one, but accelerate the other.

The changes produced in the various organs and tissues have been sufficiently stated in the above detail. I find only one or two circumstances that require mention. The brain is sometimes converted into a pulaceous mass, which finds its way into the veins, even to the vena cava; and this soft matter so much resembles pus that at first our author supposes that phlebitis had existed in the living subject. The serous membranes, instead of putrefying, seem to become more dense, and retain, as in the liver and spleen, the liquid putrefaction of their substance.

We come next to mention the *alterations characteristic of various periods of continuance in the water* during the winter. M. Devergie found that in general no change takes place until the fourth or fifth day, and the cadaverous rigidity frequently continues two, three, or even four days after immersion. This is probably owing to the coldness of the medium in which the body is placed.

From three to four days. Loss of animal heat, rigidity, no contractility under the electric current, epidermis of the palms of the hands beginning to whiten. This last is, according to our author, a most important sign, particularly when a body, after being drawn from the water, has been exposed for some days to the air. Putrefaction of the head and chest may be present, yet the appearance of the hands must be the guides as to the time of immersion in the water.

From four to eight days. General flexibility, color of the skin natural, epidermis of the palms of the hands very white.

From eight to twelve days. Flaccidity, epidermis on the back of the hands begins to whiten. The face softened and of a dull-white color, and in this respect differing from the rest of the skin.

About fifteen days. Face slightly swollen and red. A greenish

tint upon the middle of the sternum; the epidermis of the hands and feet entirely white, and beginning to wrinkle.

About a month. Face brownish red, eyelids and lips green, a brown-red patch surrounded by green on the anterior part of the chest; the epidermis of the hands and feet white, swollen, and wrinkled, as if by poultices; the scrotum and penis are greatly distended by gas, and the hair and nails are still very adherent.

About two months. Face brownish and tumefied, hairs loose, epidermis of the hands and feet nearly detached, nails still adhering.

Two months and a half. Epidermis and nails of the hands detached, also the epidermis of the feet, *but not the nails*. In females, redness of the subcutaneous cellular tissue of the neck; partial saponification of the cheeks and chin: superficial on the breasts, groins, and anterior surface of the thighs.

Three months and a half. Destruction of part of the scalp, eyelids, and nose; partial saponification of the face, neck, and groins; corrosions; epidermis of the hands and feet entirely removed, and the nails separated.

Four months and a half. Saponification of nearly the whole of the face, neck, groins, and anterior parts of the thighs; commencement of incrustations on the thighs, and of saponification of the anterior lobes of the brain; the skin is of an opaline color; detachment of nearly the whole scalp; the skull beginning to be friable.

Beyond this period, our author, from the uncertainty in the history of the cases examined by him, is unwilling to present any general characters.

As to the changes which take place in summer, the following observations are made: Ten or twelve days in the water during this season advance putrefaction as rapidly as six weeks in winter. The face is swollen and of a brownish color, the eyelids distended with gas, and the lips voluminous. The body also is more or less swollen; the skin has an opaline tint, a green spot is seen on the sternum, and the epidermis of the hands is wrinkled. There is thus a difference of at least twenty-two days in the time requisite for producing these appear-

ances. The remaining observations may be put in a tabular form:—

In summer.	In winter.
5 to 8 hours.....	3 to 5 days.
24 "	4 to 8 "
48 "	8 to 12 "
4 days	15 "

During the spring the changes are somewhat intermediate, but they are considerably affected by the previous season. "If the winter has been very severe, the progress of putrefaction will be slower in the following spring. It is not, however, equally true, that a hot summer renders putrefaction more rapid in the ensuing autumn, a fact which is accounted for by the well-known law, that water is more easily cooled than heated by an agent applied to its surface."

Finally, in calculating the period of submersion, we must always take into account the length of time during which the body has been exposed to the atmosphere after its removal from the water. Five hours, particularly in summer, are sufficient to produce the most rapid changes during the earlier stages of putrefaction. From these it passes to the more advanced with extreme quickness. Not so, however, when saponification is present, since this, for obvious reasons, is little affected by contact with the air. In winter the changes occur much more slowly.

It thus appears that the most remarkable alterations happen in bodies removed from the water in *summer*—not if they have been recently or a long time immersed, but for an intermediate period—from eight days to four or six weeks.*

I have already mentioned that the value of the deductions have been strongly questioned. Orfila is one who denies that the time which has elapsed since immersion can thus be positively decided.† Devergie, however, asserts that in several

* Devergie, vol. i. pp. 94, 164 to 234; British and Foreign Med. Review, vol. ii. pp. 397 to 402.

† Orfila has attacked Devergie very severely, in his *Erlomations Juridiques*, vol. ii. pp. 1 to 120. The main charge, however, is plagiarism, and a denial in some cases of the uniform occurrence of the changes indicated. The controversy has been continued in the *Annales d'Hygiene*, vol. v. p. 429, vol. vi. p. 209.

very recent instances, examined by himself and others, the period of immersion stated by him on merely viewing the bodies, proved to be accurate.

The experience of Dr. Ogston is not confirmatory of Devergie. In case 6, occurring in January, the head and neck were swollen, although the body had only been immersed six hours. In case 16, immersed eighty hours, and seen in October, the face was swollen, and of a dull-red color; yet Devergie prescribes fifteen days as the term of this appearance in winter. In case 18, examined in December, after twenty days immersion, the face was enormously swollen, and of a deep-red color; the hair was detaching from the scalp, and coming away by a moderate effort. The cuticle was beginning to separate from the lower half of the legs. Saponification had gone on to a considerable extent.

We are, however, not to undervalue the observations of Devergie. They were made on a limited number of cases, and it is only by increasing these that we can expect to arrive at deductions which shall be generally correct, although, doubtless, variations will always more or less occur. It is something to ascertain with some degree of accuracy, the changes correspondent to distant intervals of immersion. Had these been generally understood, they might have proved useful in the excitement which, several years since, agitated our State. The body of William Morgan, drowned some fifteen months previous (in summer) in the Niagara River, was supposed to have been found. The hair dropped out from the slightest touch; the nails of the fingers and toes were loose; the body was swollen, and the arms of a chocolate color. My former pupil and friend, Dr. John Cotes, of Batavia, examined the body. The parts under the skin had not undergone decomposition; the stomach was in a perfect state, and there was nothing manifest except the early indications of putrefaction. He deposed before the coroner's jury, that this body had probably not lain in the water more than six or eight weeks. It was subsequently ascertained to be the body of another individual. Yet, it is to be added, that there were some striking coincidences in physical marks between the murdered individual and the one under examination.

Case of Spencer Cowper. This case made a prodigious sensation at the time of its occurrence, on account of the political relations of the defendant, Cowper; it is now chiefly used as a warning to medical men not to allow political feelings or popular clamor to influence their opinions. I condense the account* given in former editions, adding some points from Howell. Spencer Cowper, an English barrister, son of Sir William Cowper, M. P. for Hertford, and brother of the Sir William who was afterwards Lord Chancellor, was, with three other individuals, tried at Hertford assizes, 1699, for the murder of Sarah Stout. The prosecution proved that Mr. Cowper came to Hertford, March thirteenth, and shortly after visited Sarah Stout, who lived with her mother, a wealthy widow, in Hertford. He dined with them, and stayed till 4 p. m., when he went away, promising to return, and, as one witness alleged, stay all night. Cowper, however, denied that he had promised to lodge at Mrs. Stout's, and in support of this denial, he proved on the trial that he had engaged lodgings elsewhere before visiting Mrs. Stout. At nine o'clock he returned, ate supper, and was then engaged in talk with Miss Stout. She called a servant, and in the hearing of Cowper bade her make a fire in his room, and warm his bed. The servant retired, leaving Cowper and Miss Stout alone. In about a quarter of an hour she heard the outer door shut, as though some one were going out. She remained above another quarter of an hour, and then returning, found that Cowper and Miss Stout were both gone. Next morning the body of Sarah Stout was found in a small stream, flowing near, but not on the surface of the water, and resting upon some stakes that were driven obliquely into the bed of the river.

The water at that place was about five feet deep. On taking the body out, it was examined externally by a surgeon, who testified that he found a little swelling on both sides of the neck, with a settling of blood on both sides, but most marked on the left. There was also a dark mark on the breast, and a slight bruise on the left wrist. There was no circular mark

* State Trials.

around the neck. On this evidence, the coroner's jury brought in a verdict of suicide.

On the twenty-eighth of April the body was disinterred for the purpose of further examination. The medical witnesses (there were six) testified that they found the head and neck so much putrefied that no opinion could be formed as to them. The stomach, intestines, and lungs, were in a sound state. The uterus was small and empty. It had been asserted that she was pregnant, and committed suicide to hide her shame. This was of course an unfounded slander. There was little or no water in the stomach, lungs, or intestines. On this state of facts, the surgeons gave a very positive opinion that Sarah Stout was not drowned, but had been killed first and then thrown into the water. This opinion was founded upon two notions then very prevalent among the vulgar, and, as in the present instance, not unfrequently sanctioned by the profession.

First. If a person is thrown, or falls alive into the water, and is drowned, abundance of water would be swallowed; some would get into the lungs and pleura, and the body being thus flooded with water, would immediately sink; whereas, if a dead body were thrown into the water, it would float, no water getting into the throat, the lungs, or the stomach.

Second. In all cases of drowning, water being swallowed, would, in the language of one of the doctors, "*have rotted the lungs and the guts.*" Yea, "*if there had been no more than a pint, it would have rotted the lights and the guts.*" "*This is done in a week's time by fermentation.*"

For the defence, Mr. Cowper, who conducted his own cause with great coolness and ability, proved from the testimony of his brother William and his wife, and other witnesses of undoubted credit, that Miss Stout (*although he was a married man*) had conceived an uncontrollable passion for him, which he in vain had attempted to repress; that when in London, she wrote to him she was coming to visit him at his chambers in the Temple; that he communicated this in confidence to his brother, and they agreed that as she was to dine that day with their father in Hatton Garden, William should say that Spencer had gone into the country on business; that she had solicited him to lodge at her mother's house during the assizes, which he had

declined; that on the ninth of March (five days before her death) she wrote him a letter, in which she plainly proposed that they should live together, [she uses the word "*cohabit*,"] adding this expression, "for come life, come death, I am resolved never to desert you; therefore, according to your appointment, I shall expect you." Mr. and Mrs. William Cowper mentioned, on their examination, her frequent fits of despondency, her repeated expression of her wish to be rid of life, and of prognostications she had uttered of her approaching death.

That on the day and evening in question, after engaging lodgings, he had visited her, and heard her give the maid orders to prepare a bed for him; but as soon as she left the room, he positively refused to sleep there, and immediately left the house. Mr. Cowper proved also, in the clearest manner, that before the clock struck eleven, he had returned to his lodgings, and that he never went out again until next morning, after the news of the catastrophe that had happened had been spread over the town.

[On this trial Lord Campbell, in his Life of Lord Chancellor Cowper, well observes: "In modern times, at the close of such a case, the judge would interfere and direct an acquittal, and the counsel for the prosecution would concur in this course."—C. R. G.]

An attempt was afterwards made to bring him again to trial, by the process called "an appeal of murder," sued out in the name of the heir at law of Sarah Stout. "There were various hearings on the subject, before Lord Keeper Wright, who called to his assistance the Master of the Rolls, Lord Chief Justice Treby, Lord Chief Baron Ward, and Mr. Justice Powell. William Cowper attended as counsel for his brother, and argued the case for him with great talent, his energy being stimulated, not subdued, by the anxiety which he felt. No misgiving was ever felt by him, for a moment, respecting Spencer's innocence; but considering the perverted and infuriated state of the public mind, it was of the highest importance that the risk of a mistaken verdict should not be again run. Upon a capital conviction in this form of proceeding, the crown has no power to pardon. On account of an informality, the first

appeal was quashed, and the lord keeper, with the unanimous concurrence of his assessors, refused to issue a writ for another."

The strongest proof in favor of the general impression of his innocence is that some years afterwards Mr. Spencer Cowper was made a judge of the court of common pleas.

A case exciting almost equal interest with the above happened in this State.

Levi Weeks was, on the 31st of March, 1800, put upon his trial before the court of oyer and terminer at New York, for the murder of Gulielma Sands. The principal circumstances were as follows: The deceased and the prisoner lodged in the house of Mrs. Ring, who was a distant relative of the former. She received attention from the prisoner, and told Mrs. Ring that she was to be married to him on Sunday, the 22d of December, 1799. When the evening arrived, she dressed herself, and came down into the lower room, where the prisoner was. Shortly after, she again went up stairs, whither Mrs. Ring followed her, saw her put on her hat and shawl, and take her muff in her hand. While in this state of preparation, Mrs. Ring came down stairs into the room, and found her husband and Levi sitting together. The latter instantly took his hat and went out into the entry, and the moment the door opened, Mrs. Ring heard a walking on the stairs, and directly a whispering at the door. She soon heard them walking along, and presently the front door opened, and the latch fell. The time she accurately fixed at about ten minutes after eight. Weeks returned to his lodgings at Ring's at ten o'clock. Gulielma's body was found in the Manhatten well on the 2d of January, 1800.

As to the circumstantial evidence, I will only add the following: It was proved by a witness that Weeks had spent the evening with him from half-past eight until ten; and again it was testified that it took fifteen minutes to walk from Ring's to the well.

The medico-legal testimony was of the following import: The body was carefully drawn up, so as not to touch either side of the well. Her hat, handkerchief, and shoes were gone, and her clothes torn. On the right hand there was something like a bruise, and there were scratches of sand upon her skin,

some of which was knocked off, and seemed to have been driven forward. The right foot was bare, and somewhat scratched on its upper part, as if she had been dragged on the ground. Her countenance was flushed, and her arms and neck very limber. Drs. Prince and Mackintosh examined the body before the coroner's jury, on the 3d of January. It was ascertained that she was not pregnant. The scarf-skin of the face was scratched, as if with gravel, and there was a bruise on the knee. There was a livid spot on the breast, but none on the neck. In the body a small quantity of water was discovered. Both these gentlemen deposed that, in their opinion, all the appearances could be accounted for on the supposition of her having been drowned.

Dr. Hosack saw the body on the day it was interred. He was struck with the unusual redness of the countenance, and upon looking at the neck, observed three or four dark-colored spots of an irregular shape, but not in an exact line. The largest were about an inch and a half, and the smallest about three-quarters of an inch. He was decidedly of opinion that these were marks of violence done to the neck, and did not conceive it possible that they could have been committed on one's own person. Other witnesses had also observed these spots on the neck.

Toward the conclusion of the trial, Dr. Hosack was again called, and asked whether there was any explanation by which the medical testimony, apparently so discordant, could be reconciled. He replied that it might, in either of two ways. First. The spots were probably not so visible when the body was first taken out of the water as after it had been exposed to the air for some days. The gradual progress of putrefaction might have developed this appearance in the injured part. Secondly. When she was first taken out of the well, it was generally supposed that the neck and collar-bone were broken. As Dr. H. did not see her until the day of interment, it is possible that the frequent turning and bending of the head, and the repeated examinations of the neck, to ascertain the injury done to the collar-bone, might have produced the spots in question, and as the body had been dead for several days, a

little violence might have produced a rupture of the cutaneous vessels, and a consequent effusion under the skin.

The prisoner was acquitted.*

I cannot avoid venturing a single remark on this case. The prisoner was doubtless innocent, but there are strong proofs to my mind that the deceased suffered violence previous to falling or being thrown into the well. The weather was undoubtedly cold, (it was during the holidays,) and the progress of putrefaction, during immersion, must unquestionably have been very slow.

The coroner's jury viewed the body on the day after it was drawn up; Dr. Hosack, and other witnesses, some time thereafter. Is it not probable that exposure to the air developed these marks of injury, and do not these marks indicate manual strangulation previous to immersion?†

* Report of the trial of Levi Weeks, etc., taken in short-hand by the clerk of the court, William Coleman, Esq.; 8vo., New York, 1800. Not long since it was asserted in some of our newspapers, but I know not on what authority, that the actual murderer of Miss Sands had suffered death for a similar crime in another country.

† In the *Causes Célèbres*, par Mejan, vol. v. p. 127, a case is related of an individual taken from the water, around whose body a bag containing several large stones was suspended. Distinct marks of compression were observed on the neck, and on dissecting through the skin, blood was found effused in situations corresponding to the external ecchymosis. One of the cervical vertebræ was luxated. The accusation was, that he had been strangled previous to the immersion; while the defence set up, rested on various proofs of previous insanity, and it was insinuated that the luxation might have originated from the fall into the well. The jury (November 19, 1808,) acquitted the *persons accused*. A similar case, where an extensive and severe fracture of the cranium was found on the head of a female drawn from a well in a cellar containing five feet of water, and being about the same to the surface, will be found in *Annales d'Hygiène*, vol. ix. p. 192. The sides of the well were smooth, and its aperture small.

I add the following curious extract from Hamilton's *History of Medicine*, as given in a review of that work in the *Lancet*, N. S., vol. viii. p. 486:—

“Among other instances of superior sagacity to which the Chinese pretend, one of the most singular, perhaps, is the method by which they affect to discover whether a man found dead by strangulation has been his own executioner, or has been strangled by others; whether in case of a body being found in the water, death preceded or followed its immersion; and whether, in other cases, death has been the result of natural causes or of felonious violence. The body being taken up in all suspicious cases, is carefully

There is a second question belonging to this subject, which is no less intricate than the first. *Was the drowning the effect of suicide, accident, or homicide?* I can offer but few observations on it.

We should inquire particularly as to the situation in which the body is found, notice whether the stream is rapid or still water, and whether its banks are precipitous or sliding. Ascertain whether the individual has labored under near-sightedness, vertigo, or symptoms of insanity. The bruises on the body should be examined, and a minute dissection be made. We should, however, recollect that the person may have precipitated himself into the water, and struck against a stone or other hard substance, and the body may have thus been wounded.* In other cases, accidental circumstances may clear up the subject, as the marks of footsteps on the margin of the water, and substances found grasped in the hands of the deceased, that have evidently been seized while making resistance.†

It is an opinion with some writers, that less water is found in the lungs of suicides than in those who are drowned by accident, or willfully; but this is evidently uncertain and unfounded.

In March, 1806, a young woman at Little Sheffield, in Yorkshire, made way with herself by breaking a hole in the ice upon a pond, and thrusting her head in, while the rest of the

washed with vinegar; a large fire is next kindled in a pit dug expressly for the purpose, and measuring six feet in length, three in width, and as much in depth; the fire in this pit is progressively augmented, till the surrounding earth becomes intensely heated, when the fire is removed, a large quantity of a vinous liquor, fermented from rice and honey, is poured in, and the mouth of the pit covered with an osier hurdle, upon which the body is stretched out at full length. A cloth, supported in the form of an arch, is then thrown over both, in order to confine the vapor arising from the vinous liquor thrown into the heated pit, and direct its action to every part of the body. At the end of two hours, the cloth is removed, and the body minutely inspected, when, if any blows have been inflicted, their marks will appear distinctly upon the body.

* Male, p. 236.

† See the case of Mr. Taylor, already noticed in the beginning of this chapter.

body remained out. This situation repelled the idea either of force or of accident.*

In 1776, a young man named Paulet, of a violent and gloomy temper, was found dead at the bottom of a well. Strong suspicions attached to two individuals. The medical reporters stated that they found sand under the nails of his hands, a circular mark on his ankle bones, external contusions on the head, and particularly above the left superciliary ridge, and some cuts on the top of the scalp. On opening the thorax, the whole extent of the trachea down to the lungs was found filled with frothy mucus, and the stomach was half full of a whitish water. They considered these as marks of death by drowning. It was proved that the well was so surrounded by houses that the slightest noise at it would have been immediately heard, and it was also constructed with sharp and heavy stones. The marks on the ankle bones were alone of a doubtful nature; but as Paulet had been melancholy, and refused sustenance for several days, and every other circumstance could be satisfactorily explained, the parliament of Toulouse liberated the accused, and agreed that suicide had been committed.†

One would imagine, says Dr. Smith, that if a person be taken out of the water tied hand and foot, there need be no hesitation about inferring that he had been forced into that situation; yet we have several cases of precisely that description, in which the presumption was clearly in favor of suicide.

In June, 1816, the body of a gauging-instrument maker, who had been missing for some days from his home, was discovered floating down the Thames. On being taken out, his wrists were found tied together and made fast to his knees, which were in like manner secured to each other. He had

* Smith, p. 275. The criticism of Mr. Taylor on this case is, however, correct: "Since it was known that the young woman had committed *suicide*, there could have been no difficulty in determining the point; but it is impossible to admit, with the reporter of the case, in the absence of all other evidence, that the situation in which the body was found repelled the idea of force, for there is no greater difficulty in conceiving that her head had been forcibly put under water, than that she should have committed the act herself." (Medical Jurisprudence, p. 145.)

† Foderé, vol. iii. p. 127, from the *Causes Célèbres*.

been in a state of mental derangement for two years. The cord with which he had tied himself was recognized as one that had hung from the ceiling over his bed, and by which he used to raise himself up, as he had been confined to bed for some weeks. He was a good swimmer, and it was presumed he had taken the precaution to prevent himself from employing that power. The verdict in this case was "found drowned."*

In another instance, a man aged twenty-eight, with a wife and children, was reduced to great distress. On a certain day he took an affectionate leave of his family, declaring that he would not return until he had obtained some employment by which he should be able to procure them bread. The following day his body was taken out of the New River, with his hands and legs tied. A card with his address was found in his pocket, and also three pence; when he left home, he had five pence, and it was supposed that he had purchased the cord with the deficient sum. The verdict in this case was "insanity."†

In 1817, says Foderé, I was called to see the body of a workman, large, strong, and in the flower of his age, who had been taken out of the Yll. His hands and fingers were tied together with a silk ribbon, in numerous folds. The hands evidently could have been very easily disengaged. There were no marks of external injury, and no swelling around the ligatures. His dress was uninjured, and nothing was taken from him. On examination, there were no marks except those common to drowning. Our author gave it as his opinion that this was a case of suicide, and that he had probably tied the ribbon with his teeth.‡

* Smith, p. 276.

† Paris, vol. iii. p. 42.

‡ Dictionnaire des Sciences Médicales, vol. xxiv., art. *Indices*. A similar case is related in the *Annales d'Hygiène*, vol. ix. p. 207. The body of the *Sieur X.* was taken from the Seine at Paris, having the feet, wrists, and neck tied. None of the knots, however, were tight, and they left but a very slight impression on the skin. On dissection, the liver and heart were found to bear the marks of long-continued disease. The medical examiners (Marc, Guichard, etc.) from these circumstances, and the total absence of injury, gave the opinion that this was a case of suicide. They add, that in each case

The above are examples where there may have been doubt as to suicide or homicide. I will conclude with one where the question was suicide or accident. It arose in the English court of exchequer in 1826.

An individual named Rainer had insured his life for £3000 in the Rock Life Insurance. Now, it is one of the provisions in a policy, that if the insured meets his death by suicide or dueling, the insurance shall be void. Mr. Rainer, the person insured, had been insane for some time. He resided at High-bury, and on the 15th of March, between five and six o'clock, left his home without the knowledge of his family, and called at several places, exhibiting strong symptoms of agitation and excitement. He then took the road to Finchley, and on reaching a pond on the premises of a farmer, was drowned. It is probable, from the state in which his shoes and stockings were found, that he had walked into the pond with his clothes on; that he had then returned, undressed himself, laid his clothes in a convenient place, and in such a manner as to indicate that he intended to dress himself after leaving the water.

It was urged, that if this was a case of suicide, he would have thrown himself into the water with his clothes on; and some medical witnesses were of opinion that he died from apoplexy, occasioned by immersion in cold water while under a high fever. The chief baron remarked to the jury, that this was a case in which there was a great want of facts, and that they could only decide on probabilities. The verdict was in favor of the executors.*

It is not necessary to state the laws of various countries against the crime of murder. Whatever may be the mode adopted to destroy life, it is universally visited with the highest punishment. In a recent English law, called Lord Lansdowne's Act, (9 Geo. IV. chap. 31,) the *attempt to drown, suffocate, or strangle a person*, is declared a felony, and made punishable with death.

they were slip-knots, and apparently made by the individual to put it out of his power to help himself in the water.

* Garret and others (executors of Rainer) v. the Rock Insurance Company. I copy this case from a newspaper.

CHAPTER XV.

WOUNDS ON THE LIVING BODY.

1. Of wounds in general—division of them into slight, dangerous, and mortal—enumeration of each. Circumstances which may aggravate danger of wounds. A. The age and constitution of the patient and his maladies, either hereditary or accidental. Habits of intemperance. Supervention of diseases, and how they are to be estimated—erysipelas—tetanus. B. The passions of the patient—negligence or delay. C. Insalubrity of the atmosphere. D. Ignorance or negligence of the surgeon.
2. Nature and prognostics of wounds of particular parts. Wounds of the head—of the face—of the neck—of the thorax—of the abdomen—of the extremities. Wounds from fire-arms. Laws as to the time within which death from wounds is deemed murder.
3. Of mutilation. French laws against it—English—Coventry Act—Cases. American laws.

It has been already stated, but it is proper to repeat in this place, that the term WOUND, in LEGAL MEDICINE, comprehends all lesions of the body, and in this it differs from the meaning of the word when used in *surgery*.* The latter only refers to a solution of continuity, while the former comprises not only these, but also every other kind of accidents, such as bruises, contusions, fractures, dislocations, burns, etc. etc. In this sense, then, the term is to be understood in our future remarks. The *legal* definition, as in force in England and in this country, will be seen below.† The term is thus employed in a restricted

* Ballard and Marc, however, object to this, and recommend the word *LESION*, for the general term. *Lesion from some external cause.* (Dictionnaire des Sciences Medicales, art. *Blessures*.)

† In *Moriarty v. Brooks*, Lord Lyndhurst, Chief Baron, said: "The definition of a wound, in criminal cases, is an injury to the person by which the skin is broken. If the skin is broken, and there was a bleeding, that is a wound." (6 Carrington and Payne's Reports, p. 684.) In *Rex v. Beckett*, (1 Moody and Robinson, 527,) it was decided, that "to constitute a wound, the external surface of the body must be divided." (American Jurist, vol. xviii. p. 424.) And again: "To constitute a wound, there must be a sepa-

sense, and injuries of a most serious nature must be included under general enactments, scarcely reaching the occasional

ration of the whole skin; a separation of the cuticle is not sufficient." The Queen *v.* McLaughlin. (8 Carrington and Payne, 635.) The wound may, however, be *internal*; as in Rex *v.* Smith. (8 Carrington and Payne, 173.) There was a blow with an iron hammer on the face, by which the left jaw was fractured in two places, and the skin *inside* of the mouth was broken, but not at all externally. Judge Parke observed: "There must be a wounding; but if there be a wound, (that is, if the skin be broken, whether there be an effusion of blood or not,) it is within the statute, whether the wound is external or internal." In France, the legal and medical definitions accord. "By wounds (*blessures*) we understand, in legal medicine, every local effect on the body produced by an act of violence, or by the application of any caustic or corrosive agent. Hence under this head are to be included bruises and contusions, fractures and dislocations, sprains and burns, comprehending scalds and sores." The explanation of this is, that the word *blessures* is not defined by the law, and the medical construction is consequently followed. (Brierre de Boismont and Devergie, quoted by Taylor, p. 489, and Poiroux, p. 335.) The last author remarks that the term *blessures* is generic, while *plaie* (a wound with solution of continuity) is a species included under it.

The following are cases apparently parallel, yet not without anatomical reasons to justify the legal decisions:—

Central Criminal Court, January, 1848. Before Mr. Justice Patteson. Reg. *v.* Jones. The prisoner was indicted for wounding with intent to do grievous bodily harm. Bedkin, for the prosecution, stated the nature of the wound to be as follows: The prisoner had come behind the prosecutrix, and given her a violent kick in the private parts, and that had been followed by an occasional discharge of blood, mingled with urine; but the surgeon could not undertake to say from what precise vessels the blood originally flowed.

Patteson, J. Then I do not think the more serious charge in this indictment sustainable. There may have been no lesion of any of the vessels at all. Blood may be discharged from those parts simply from natural causes.

Ibid. February 3, 1849. Before Mr. Justice Creswell. Reg. *v.* Waltham. The prisoner was indicted for wounding the prosecutor, with intent to do him grievous bodily harm. It appeared from the evidence that the prosecutor, who was a policeman, while endeavoring to separate the prisoner and a man with whom he was fighting, received from the former a violent kick in his private parts. From the testimony of the surgeon, it appeared that the external skin was unbroken, but that the lining membrane of the urethra was ruptured, which caused a small flow of blood, mingled with urine, for two days. That membrane is precisely the same in character as that which lines the cheek and the external and internal skin of the lip.

Perry (for the prisoner) objected that this was not a wounding within the statute, and cited Regina *v.* Jones; that case was very similar to the present; there was no external wound.

Creswell, J. If the cases were similar, I should abide by the ruling of Mr.

enormity of the offence. Thus, a ruffian fractures a collar-bone with the blow of a hammer, and yet the skin is not

Justice Patteson; but there is a great difference between them. I think this is a wounding within the statute. (Cox's Criminal Law Cases, vol. iii. pp. 441, 442.)

[Most modern surgical writers, in speaking of wounds, adopt the description given of them by Galen, (*De Constitutione Artis Medicinæ*, cap. v., Kuhn's edition, vol. i. pp. 237-260,) who, in applying other terms to solutions of continuity in other parts of the body, restricts this term to solutions of continuity in the flesh; and would not apply it even to these unless produced by cutting instruments. "Verum in osse quidem fractura affectus vocatur; ruptura vero in carnis musculorum partibus, quæ extensione concitatur; quum autem fibræ peræque tensæ rumpuntur, volsura vocatur affectus; eodem vero modo quæ ruptione continui sit in carne solutio, vulnus, quod non extensione, sed incisione prodit; verum si, quod vulnerat, acutum ac tenue sit, punctura et punctio nominatur: si vero grave, contusio vel collisio; ex corrosione vero qui in osse quidem oboritur caries; qui vero in cæteris ulcus." In the use of these restrictive terms, Galen's object is merely to point out the varieties in the class of external injuries; and he admits that other terms might answer the same purpose. "Sed nominare quidem alio modo concedatur." (Pages 238, 239.)

But though the term *wound* is usually restricted by surgical writers to a solution of continuity in the fleshy parts, or in the fleshy and bony parts collectively, resulting from a blow or other similar mechanical injury, yet some would give it a more extensive application, and make its surgical as comprehensive as its popular meaning. The word indeed, in our own, as the corresponding word in other languages, is, properly speaking, a generic expression. Our modern surgeons all use it as such; and the varieties of wounds find, perhaps, in no other language, so many corresponding descriptive words, to fix an accurate knowledge of them in the mind of the mere English scholar. Thus *cut, incision, gash, chop, slash*, convey not only an idea of the wound, but of the manner of its infliction, and of the instrument producing it. So, also, *thrust, stab, puncture, jab, pick, prick, bite, sting*; and, again, *contusion, stroke, shore, knock, slap, blow, shot, shave, laceration, hurt, crush, rent, jag, tear, rake, scratch, graze, chafe, ruffle, abrasion, erosion, rub, scrape, peel*, not to speak of terms applied especially to injuries of the bones, as *fracture, break, crack, fissure, dinge, dent, flaw*; or to the joints and their dependencies, as *luxation, dislocation, displacement, wrench, twist, sprain*, etc., all of which, in popular military and legal language, fall under the common denomination of wounds.

Nor is it essential to a wound that there should be a dissection of the tissues. The rebound of a cannon-ball, without even abrading the skin, may inflict a wound that will terminate fatally, or lead to disorganization or mortification of the injured member; so, also, may the crushing weight of a railroad car. Celsus, the best medical authority among the ancients, speaks of wounds as usually produced by weapons or by the bites of animals; but he lays down no arbitrary definition of them as distinct from mechanical injuries of any shape or form whatever. Thus, in book v. chapter xxvi. sec. 1,

abraded. How, under existing definitions, can he be adequately punished?

The question which arises in all cases of wounds that come under judicial investigation are the following: How far has the person who caused the injury contributed to the death of the deceased, or to the lesion of one or other of the functions of the body? And again, to what class is a certain wound to be referred? These are inquiries of great magnitude, and correct views as well as stable principles are needed in order to answer them properly. Medical and surgical works are filled

he uses the word *vulnus*, the equivalent of our word *wound*, for any lesion, and not merely a breach of continuity, "*cum quid extrinsecus lassit.*" Among such lesions, he includes those in which the injury affects the deeper tissues, while the skin remains sound. "*Hæ gravissimorum vulnorum curationes sunt. Sed ne illa quidem negligenda ubi integra cute interior pars collisa est; aut ubi derasum, attritumve aliquid est; aut ubi surculus corpori infixus est; aut ubi tenue, sed altum vulnus insedit.*" (Cap. xxv. § 35.)

His use of the term would also include lesions from chemical agents, burns, scalds, the severe erosions from caustic acids and alkalies, or from any other equally corrosive acid or destructive agencies, which have ever been or may ever be employed as weapons of attack or defence.

Forsaking the authority of Celsus, some surgeons will not admit a lesion to be classed among wounds, unless the breach of continuity which characterizes it communicates with the skin, or has its seat upon the surface of the body; such a restriction is warranted neither by logic nor pathology. Wiseman (*Chirurgical Treatise*, fourth edition, folio, London, 1705) defines a wound to be "a solution of continuity in any part of the body suddenly made by anything that cuts or tears with a division of the skin." * * * "But by the word *skin*," says he, "I understand not only the external cutis, but also the inward membranes of the gullet, ventricle, guts, bladder, urethra, and womb, all which are capable of wounds from sharp instruments, either swallowed or thrust into them." (Page 322.)

But Banester, a much earlier English writer, and not less worthy of respect than the former, comes somewhat closer to the accepted popular and legal meaning of the word, when, in his second book, treating of wounds, he says: "The causes are either bodies without life, or else living things. Things without life that wound a man do it either by cutting or bruising; if by cutting, we call it simply a wound; if by bruising-wise done, we call it a contused wound, or *ecchymosis*." (The works of that famous Chirurgien, Mr. John Banester, quarto, London, 1533, p. 146.) A fresh cut communicating with the surface he calls "a green wound" (p. 147); and, says he, an "*ecchymosis*," that is, effusion and going together of blood under the skin, "is a kind of solution of continuity, which for the most is accompanied with some contusion and ruption." (Page 170.)—J. W.]

with instances of remarkable recoveries from the most dreadful wounds, and also with cases of death from apparently the slightest ones. If we take these as our guide, the consequence will be that nothing of a determinate nature can be agreed upon: and every physician, whenever he enters a court of justice, may, by the aid of a corresponding example, prove that a dangerous wound is not so, and that its fatality has been owing to ignorance or neglect. Such power is too extensive and too important to be granted to every medical witness; and whatever we take from his hands and refer to sound principles and general rules is a solid gain to the cause of truth and justice.

In further proceeding with my observations, I shall, in the first place, notice the subject of wounds in general, and afterwards examine the nature and prognostics of wounds of particular parts. The subject of mutilation, from its entering so much into our statute law, will form a third section.

1. *Of wounds in general.*

Wounds, from their nature, may be either *slight, dangerous, or mortal*. By a slight wound is meant one in which there are no parts injured that are important to carrying on life or any of its functions, and whose uniform course is to heal quickly, and to leave no lesion or deformity. A dangerous one implies a wound which, without being mortal, is still not exempt from danger, and presents more or less difficulty in its cure. Lastly, mortal wounds comprehend those whose consequence and effect is death. In this sense only is a wound in legal medicine termed mortal. More minute divisions than these which I have named may, however, be made, and indeed are indispensable. Thus a wound may be in itself mortal, or it may be mortal by accident. It may be in itself dangerous, or it may become so from some complication, or from not having been properly treated.* Even slight wounds may become

* Mare divides wounds into mortal and not mortal. The first is subdivided into wounds of necessity mortal, and wounds mortal by accident. The second into wounds completely and incompletely curable. Dr. Biessy classifies

dangerous from neglect, from a debilitated or diseased state of the system, or from mal-treatment, such as endeavoring to excite suppuration when the aim ought to be to promote adhesion. In such cases the blame should be laid where it properly belongs.

Circumstances as well as accident have a considerable effect on wounds. Bohn suggests several instances of this nature, in which their mortality is prevented by particular phenomena. Thus, a small portion of the omentum, or the fat of the intestine, may so place itself in the mouth of a wounded blood-vessel in the abdomen as to prevent a hemorrhage, while, if not thus obstructed, it would be mortal.* Again, it has been repeatedly observed by surgeons, that there may be such an adhesion of the pleura to the lungs as that the blood or pus from the latter will flow outwardly, when they have been injured by a penetrating wound. The same author remarks, that it has never been demonstrated, and indeed in the nature of things it never can be proved, that a wound from which there is a recovery, is precisely similar to one which has proved fatal, although externally they may be similar in every respect. In the one case there can be no dissection to prove its nature, and in the other there may have been many peculiar circumstances not attendant on the former.† This observation is in itself a sufficient answer to the argument already referred to, of proving the possibility of recovery from dangerous wounds, by a reference to similar instances.

The subject may be further illustrated by examples. A man, says Bohn, received a wound in the bottom of the stomach; a severe hiccough, faintings, and retchings come on, while the

them into slight and severe wounds, and divides the latter into those which may be perfectly cured, those which may be cured, but leave some deformity or weakness, and those which may prove fatal.

* Bohn, p. 31. He mentions a dissection in which the right iliac artery was found wounded, and life had been prolonged for thirteen days, evidently from this cause. [I have known the vertebral artery divided by a stab, and the loss of blood from it arrested by the drawing of the neighboring soft parts tensely over it; life was thus prolonged for several days, and the patient ultimately died without renewal of the hemorrhage, and from other causes than the loss of blood.—J. W.]

† Bohn, p. 27. "Dubium an vulnus sanatum exacte idem cum non sanato fuerit."

half-digested food that he has taken passes out through the aperture. This individual is, however, cured in a month's time; while another whose wound is accompanied with similar symptoms, except that he does not hiccough, and which in itself is a favorable symptom, dies in three days. Shall we say that the latter was not mortally wounded because the former escaped? Dissection will teach us the incorrectness of this deduction, and that in the instance of mortality, the wound has been rather lateral than deep, and has touched the left gastric artery, in consequence of which there has been a profuse hemorrhage into the abdominal cavity. Again, an individual receives a violent blow on the head, which causes a depression of the cranium and is accompanied with a considerable hemorrhage from the head and ear, and a loss of sense and motion. After a day or two, the depressed piece of bone is raised, he recovers his senses, the hemorrhage ceases, and at the end of some weeks the patient recovers. Another is injured precisely in the same manner, is treated similarly, and, notwithstanding, dies at the end of seven days, without ever recovering from the state of coma, and on dissection, extravasated blood is found in the ventricles of the brain.*

These instances are sufficient to prove how little dependence is to be placed on analogy, and they also illustrate the importance of fixed rules concerning the mortality of wounds, founded exclusively on anatomical and physiological data.

A strict definition of life is not necessary at this time, and it is sufficient to state that it depends on the union and reciprocal influence of the functions which compose it, and particularly of the circulating, nervous, and respiratory systems. Lesions of the chylopoietic system come next in order, as the body cannot survive without nourishment, and the danger to life will of course be in proportion to the extent of the injury, and the immediate necessity of the organ. Wounds which rupture the large blood-vessels in one or other of the large cavities, such as the head, the thorax, or the abdomen; those which penetrate the auricles or ventricles of the heart, the

* Bohn, pp. 28, 29.

trunk of the aorta, or vena cava are *mortal*. There are, however, so many cases on record in which individuals are stated to have survived for some time with large abscesses in the brain, or even a ball on that part, that we are justified in viewing wounds of the heart as more fatal than those of the head. Next to these are wounds which, from their depth, penetrate into the spinal marrow—wounds of the head, complicated with such severe injury that venesection and the trephine do not alleviate them; a division or twisting of the spinal marrow in the cervical vertebræ; a division of the eighth pair of nerves; and a general affection of the nervous system from blows or injuries on parts which are the centre of its various departments, such as the pit of the stomach. In the next place may be mentioned, as mortal wounds, such as prevent the function of respiration, a total division, or a large wound of the trachea; and particularly, if in the latter case, the under lip of the wound is retracted inward; wounds penetrating through the bronchi, and wounds of the diaphragm, particularly of its tendinous portion. To this class belong also extensive wounds of the pharynx, cesophagus, and stomach, of the duodenum, thoracic duct, and mesentery, and particularly if a large number of the lacteals be divided, together with severe wounds of the liver, spleen, pancreas, gall-bladder, and the ductus cysticus, and choledochus. Wounds of the urinary passages, kidneys, ureters, bladder, impregnated uterus, and amputation of the male genital organs, are all ordinarily mortal, unless immediate aid be afforded, as are also extensive and penetrating ones from fire-arms accompanied with fracture of bones.

All these accidents, from the importance of the organs that are injured, the extravasations that occur, or the hemorrhage which accompanies them, and which it is often impossible to check, are usually mortal. Such, however, are the powers of nature, and so extensive are its resources, that hope should seldom be abandoned. If called upon to make an immediate report, it is proper to form a prognostic on these principles, and to mention the danger that is present. On the trial, however, the conviction must be decidedly stated that the wound

was a mortal one, and that no surgical aid could have saved the patient, or when applied, had no beneficial effect.

Among *dangerous wounds*, or those concerning which we cannot give a decided prognostic, must be ranked such as are inflicted on organs essential to the exercise of the vital, natural, or animal functions; and as to their consequences, they may be divided into those which may become mortal, and those which may interrupt the exercise of any function. To the first class belong all penetrating wounds, though unaccompanied with symptoms that indicate immediate danger, all contused wounds, whether on the head, thorax, or abdomen; all wounds of the extremities, and particularly where surgical aid cannot be procured in time to suppress hemorrhage; and all compound fractures and luxations, particularly if the part be much surrounded by nerves and muscles, and if it be near a joint. Even simple contusions or blows may become dangerous from a rapid disorganization of parts and a consequent mortification; and especially, if, on tendinous or ligamentous parts, the super-vention of tetanic affections are to be dreaded.

In the second class are included all wounds made in any of the secretory organs and their ducts; in the organs of sense, as the eye, ear, nose, and mouth; in the generative organs, as the testicles, penis, and unimpregnated uterus. Also, fractures of the clavicle or sternum, and depression of the xiphoid or ensiform cartilage; transverse wounds of the great pectoral or dorsal muscles; and wounds of the muscles of the abdomen, particularly near the linea alba, and pubes; wounds of the perineum combined with injury to the canal of the urethra, pricking of the tendons of muscles, together with wounds of important branches of nerves.

Slight wounds comprehend those injuries in which the skin and the muscles are divided, the latter in the direction of their fibres, and where no tendon, aponeurosis, large nerves, or blood-vessels are touched, and the system has not received a severe shock. To this class also belong simple luxations and fractures.

But, as we have already observed, there are circumstances which render this division an arbitrary one, and which cause a mortal wound of the lowest class to be inevitably mortal, a

dangerous one to become mortal, and a slight one dangerous. These circumstances may be reduced into four classes, each of which deserves particular notice.

1. The constitution and age of the patient, and his antecedent or coexistent maladies may exercise a baleful influence on the injury received. Thus, for example, he may be advanced in years, and the wounds inflicted will then be less likely to heal. Or there may be a complete transposition of parts; the heart is sometimes found on the right side of the thorax; the spleen has been discovered to occupy the place of the liver; the stomach has descended as low as the umbilical region, or even lower, while the bladder has risen into the abdomen. It would certainly be unjust, except in cases of premeditated murder, to consider the criminal as responsible for the fatality of wounds given under such circumstances. Again, an individual may be suffering under hernia, and in that situation may receive a mortal wound from a cutting instrument, or may die from a contusion or blow on the part, which, under other circumstances, would not prove dangerous.* The condition of the wounded person may also be rendered hazardous from a variation in the ordinary distribution of blood-vessels, from the presence of aneurism,† from an extreme thinness of the bones

* Bohn, pp. 70, 71.

† Two men, long at enmity, met in a public and much frequented place. The one alighting from his horse, passed to the place where his adversary stood, addressed some contemptuous words to him, and gave him a blow on the shoulder with a riding whip that he held in his hand. The other furiously ran after him, but before he had gone a dozen paces, he fell down dead. There were no external marks of injury, but on dissection, an aneurism, for which he had frequently consulted the physician, was found to have burst. (Chaussier, p. 11.)

A respectable individual put an end to his existence by hanging himself. Dr. Wesener was directed by the proper officers to examine the body. The examination of the thorax and abdomen presented nothing beyond what is usually observed in such cases; but on opening the head he found the following deviation from nature: about the middle of the sagittal suture, the bones of the cranium were, for the space of a sixpence, as thin as the most delicate lamella of bone, and in this spot were two openings, each about the size of a pin's head, through which two vessels ran, which arose from the superficial veins of the dura mater, and anastomosed with the veins of the scalp. On cutting into the scalp, though with great care, the blood flowed

of the cranium, or a venereal caries of the same part; from having large umbilical vessels, or finally, from being afflicted with some chronic disease, or suffering under debility.* Slight

over the galea aponeurotica in such quantities as quite to redden it, and it appeared, on examination, that the emissaria santorini were cut through. It is evident from this statement, that a blow on the spot in question would probably have caused death, either by direct depression, or by causing internal hemorrhage. (Quarterly Journal of Foreign Medicine and Surgery, vol. ii. p. 105, from Hufeland's Journal.)

Another case equally striking is quoted from Franck, of a man wounded with a sabre on the frontal bone, an inch and a half from the sagittal suture, where it is obliterated in the adult. A portion of the external table of the skull was removed, and after being neglected for some days, the patient applied to Franck. He saw symptoms that induced him to apply the trephine in the neighborhood of the wound. As soon as he reached the diploe, a torrent of blood issued forth, and the patient died the same day of the hemorrhage. On dissection, seven vascular communications were found between the dura mater and diploe, through so many foramina in the internal table of the skull in this place. (Notice of Robert on the Influence of Anatomical Varieties on Surgical Operations, in Medico-Chirurgical Review, vol. xiii. p. 299.)

The late Mr. Ashmun, in his Lectures on Medical Jurisprudence, mentions the following as occurring in the State of Massachusetts, in 1818: A small stone, thrown so as to strike the side of the head, caused death in ten minutes. There was no external bruise and no fracture. The cranium was found to be extremely thin. The ventricles were filled with coagulated blood, and the pia mater and vessels of the brain were gorged with blood. The dura mater was healthy. The verdict was manslaughter, but Mr. Ashmun suggests that it ought to have been excusable homicide. (American Jurist, vol. xv. p. 108.)

* As, for example, a case of this description: A man had for some years been laboring under a discharge from the left ear, which left him deaf. Being in ordinary health, he received a blow in a quarrel, on the chest, and in attempting to retaliate, struck his head against the edge of an open door. The blow caused a small wound on the right side of the forehead, with much ecchymosis, though with very little external hemorrhage. Intense pain at the seat of the blow followed, which soon became general over the whole forehead. Delirium ensued, and the *discharge from the ear ceased*. He was admitted into St. George's Hospital, but remedies produced no good effect, and he died somewhat comatose, within four weeks after the injury.

On dissection, no injury of the bone or its covering, nor any extravasation of blood at the seat of the wound was discovered. The left hemisphere of the cerebellum was soft and discolored, and in the interior of the middle and anterior lobes was a large abscess, containing three ounces of fluid pus and its parietes soft and green. At the bottom of the abscess, the brain adhered to the dura mater, covering the thin roof of the tympanum, in the centre of which a small opening in the dura mater allowed a probe to strike

wounds may also be rendered dangerous, and even mortal from an extreme irritability of the nervous system, from previous habits of drunkenness, or from scorbutic, cancerous, cachectic, or venereal habit. And above all, is there serious apprehension when these are inflicted on persons of hemorrhagic disposition. Cases of this description are by no means uncommon, and the slightest abrasion in them will often cause alarming discharges.* All the possible circumstances now

on dead bone about the size of a sixpence. The membrane of the tympanum was also partially destroyed.

It was thus evident, that there had been a disease of the brain of long standing, and all that the blow could have done, was to hasten death by exciting the abscess already existing. Even this was in a measure doubtful, as the only blow given was on the chest. (*London Med. Gazette*, vol. xvii. p. 157.) See also a paper by Cæsar Hawkins, on the discharges of pus from the ear, after injuries of the head. (*Ibid.*, vol. xvii. p. 261.)

* Metzger (p. 327) mentions a case of death produced in this way by a scratch of the thumb nail. Several relatives had previously died in a similar manner.

The following are references to American cases of this description:—

New York Medical Repository, vol. vi. p. 1. An account of this hemorrhagic disposition occurring in several families, by Dr. John C. Otto, of Philadelphia. The males alone were subject to it, though females were capable of transmitting it to their male children. These families resided in New Hampshire, and Dr. Otto adds, that Dr. Rush informed him that he had, during the course of his practice, been twice consulted in similar cases in the State of Pennsylvania. Another instance had been communicated to Dr. R. by Mr. Boardley, of a family in Maryland, where also the males alone suffered; and additional particulars concerning this are given in *Coxe's Medical Museum*, vol. i. p. 286.

Coxe's Medical Museum, vol. i. p. 284. Case by Dr. E. H. Smith, in a boy, fatal at four years of age.

New England Journal of Medicine and Surgery, vol. ii. p. 221. Cases by Dr. Hay of Reading (Massachusetts.) The hemorrhagic disposition appears to have been in this family for upward of a hundred years. The males alone were subject to it, but in some cases the sons escaped, while the grandsons suffered severely, and some died prematurely.

American Medical Review, vol. i. p. 278. Case by Dr. Gideon Humphrey, of a family in Pennsylvania.

Transactions of the Physico-Medical Society of New York, vol. i. p. 305. Case by Drs. William and Samuel Buel. All the sons of a family were affected; the sons of one daughter, and her male grandchildren—but not the female.

enumerated should be kept in view, and particularly when wounds have been involuntary, or when they belong to what is termed in law, manslaughter.

North American Medical and Surgical Journal, vol. vi. p. 37. Case by Dr. Reynell Coates, of a young gentleman in Pennsylvania, of the family mentioned by Dr. Humphrey. Dr. Coates notices several of the American cases in this paper.

Maryland Medical Recorder, vol. ii. p. 263. Case by Dr. Jameson.

Transylvania Journal, vol. iv. p. 518; and vol. v. p. 133. Two cases by Dr. Hughes, of Kentucky.

Boston Medical and Surgical Journal, vol. viii. p. 219, by Dr. Woodward, of Quincy.

I have also a manuscript case communicated to me by Dr. Curtis, a graduate of the Western Medical College, and which formed the subject of his inaugural dissertation. It occurred in the practice of Dr. Sprague, of Otsego County (New York.) Several sons and a grandson were successively affected with copious hemorrhages from the slightest injuries. Shortly after birth, in each of them, purple spots appeared on various parts of the body. The discharge in several instances yielded readily to the operation of saline cathartics.

Of recent foreign cases, I have noted the following:—

Medico-Chirurgical Transactions, vol. iii. p. 224, by Mr. Blagden.

Edinburgh Medical and Surgical Journal, vol. xxv. p. 291, by Mr. Davis, surgeon, near Bristol. A family in which none of the males reached manhood—the females escaped.

Ibid., vol. xxv. p. 454 (from Hufeland's Journal.) Cases by Dr. Elsaesser, near Stuttgart, and Dr. Krimer, of a similar character.

Ibid., vol. xxvi. p. 33, by Mr. Murray, of Alford.

Edinburgh Medical and Surgical Journal, vol. xxxii. p. 439 (from Rust's Magazine,) by Dr. Steinmetz; the males of three generations.

Ibid., vol. xxxvi. p. 217, by Dr. Riecken, of a family at Birkinfield, in Oldenburgh.

Lancet, N. S., vol. xiii. p. 132. Cases quoted by Mr. Wardrop, vol. xxiv. p. 137; by Mr. Liston, vol. xxvii. pp. 185, 404, 649, by Mr. Lane, Dr. Burnes, and Mr. Smethurst. In this last, the subjects were females.

London and Edinburgh Monthly Journal Medical Science, vol. ii. p. 391.

Case of a female, by Prof. Quadrat, of Prague, from Gazette Médicale.

See also, Dr. Hay's paper, *ibid.*, p. 264; Dr. Allan's, p. 501; Mr. Miller's, p. 567; Dr. Todd's, p. 926.

Provincial Med. Journal, May, 1842. Case by Mr. Hunt.

American Journal of Medical Sciences, vol. iii. p. 196; and vol. v. p. 202, (from a German Journal,) by Dr. Schreyer, of Votsberg. The male children alone affected; and of these, three only out of five. The residue remaining perfectly healthy.

North American Medical and Surgical Journal, vol. ix. p. 123, (from the

But it may happen that while the patient is suffering under a wound, he is attacked with disease and dies, and the question then arises, whether this fatality is owing to the wound, or the disease. In some instances, the solution is easy, but in others it is attended with considerable difficulty. Thus, for example, a fever attended with comatose symptoms may supervene on a wound of the head, and pleurisy may follow a wound of the thorax. The probability evidently in such instances is, that the injury has produced the disease; but there is, notwithstanding, sufficient latitude left for doubt, and circumstances may arise which will prevent us from assigning the wound as the cause of death. On the other hand, should gangrene, buboes, petechiæ, or the other symptoms of malignant fevers appear on a wounded person, in a hospital, or during the warm season of the year, or during the prevalence of such an epidemic, it would certainly seem that the cause of death is distinct from the danger of the wound. A similar observation will apply when an inflammatory or typhus fever supervenes on slight wounds, and renders them fatal.*

Proceedings of the Medical Society of Copenhagen.) A case by Dr. Thal.

Medico-Chirurgical Review, vol. xxv. p. 232; and vol. xxxi. p. 540.

Cases by Prof. Kuhl, of Leipsic.

London Med. and Surg. Journal, vol. viii. p. 276. Cases of Laroche, in the Hospital de la Pitié. He was forty-one years old. Several of his brothers and sisters had suffered from hemorrhage. The parents were healthy, but a maternal uncle had died from this cause.

Medico-Chirurgical Review, vol. xxxiii. p. 226, several cases quoted from the *Archives Générales*, vol. xxxix. p. 276. Case by Dr. Wilmot, from the Dublin Journal.

British and Foreign Med. Review, vol. ix. p. 247. Case in a family, by Dr. Dubois, of Switzerland.

There is also a copious list of references in Edinburgh Med. and Surg. Journal, vol. i. p. 304.

* Bohn, p. 83. This author divides the symptoms into three classes.

"Alia ex vulnere ipso, ut tali, hinc à parte læsa immediate emergant; alia aliam extra vulnus causam agnoscant; alia indifferenter se habeant, id est, modo à vulnere, modò aliunde eveniant; probe omnes ac singulæ ponderandæ sunt in vulnerato circumstantiæ, et ex harum demum collatione, cujus generis sint illa individui presentis, prudenter inferendum."

In the Commonwealth v. Green, (Ashmead's Reports in First Judicial District, Pennsylvania, vol. i. p. 289,) the doctrine is distinctly laid down, that when a wound not mortal in itself, from want of proper applications or neglect,

The following instance, in which Zacchias was consulted, will illustrate the difficulty that may occur. During a period when the plague raged at Rome, one Ansovini received in a quarrel, a wound on the head, which denuded the bone, but left no fracture. He withdrew by the assistance of two friends, one of whom continued to visit him, but died in four days thereafter of the plague. The wound appeared favorable for the first three days, but at the termination of that period, a fever came on, accompanied with headache, bilious vomiting, and violent inflammation of the wounded part. On the fourth, the wound was gangrenous, and petechiæ and buboes occurred; on the sixth day death followed. The person who inflicted the wound was arrested by the minister of justice, on the ground that it was the cause of death, or at least it predisposed the individual to the attack of the plague. Zacchias was consulted by the friends of the accused, and he decided that the wound had not been the cause of death, because there were no symptoms immediately after its infliction that indicated a mortal injury to the head; that the appearances which supervened were too rapid in their progress to appertain to it, and evidently belonged to the plague; and it was also manifest that he had taken this disease from the friend who had visited him. Finally, two diseases were present in the individual, and the ordinary course of one is fatal, while that of the other is to proceed to a favorable termination. It is certainly proper to assign the former as the cause of death.*

Mr. Taylor also states some important cases: An individual, in an attempt at suicide, while laboring under delirium from scarlet fever, nearly severed the windpipe. Death ensued the next morning, but it was found that little blood had been lost, and that none of the important vessels of the neck were injured. The jury were informed by the surgeon that death in this case was owing, not to the wound, but to the disease, and that it would in all probability have occurred at the same time, and

turns into gangrene or fever, and the patient dies, the person inflicting it is to be deemed guilty of murder, if the testimony required in addition shall warrant it.

* Zacchias' Consilium, No. 74.

under the same circumstances, if no attempt on life had been made.

In another instance, a wound was made in the neck with a penknife, and some of the branches of the subclavian artery were divided. The wound went on favorably, but secondary hemorrhage occurred twice, in consequence of the patient having violently torn away the dressings. After lying for about three weeks with a fair prospect of recovery, he died suddenly. On dissection, a large abscess was found, occupying one of the hemispheres of the brain, with an effusion of water between the membranes. These circumstances, combined with the fact that he had previously complained much of his head, induced the medical witnesses to depose that death was occasioned by the abscess, and that this had no connection whatever in its origin with the wound. Indeed, the hemorrhage would, in their opinion, have tended to stay the activity of the disease, and probably to prolong life.*

In cases brought before courts of justice, it is, however, to be recollected, that they are far from being as easy of solution as those just quoted. They are generally of intemperate persons who have engaged in brawls, receive injuries, and after an uncertain period, die; and the question arises whether the habits of drunkenness or the blow has caused the loss of life. As a general rule, I would always lean towards the accused, unless the proof of malice is conclusive. The habitual use of spirituous liquors is so apt to produce a diseased state of the system generally, that with the above exception, we shall best promote the ends of justice by considering the offence as a secondary one.

Discussions on this subject, however, are so frequent, that it can hardly be dismissed with these remarks; and I will, therefore, in addition to what has been said in a previous chapter, detail some cases as illustrative of the testimony and inferences proper on such occasions.

An intemperate individual in Philadelphia died thirty-eight hours after an affray. He walked and spoke after it, and even drank part of a pint of spirits, but was shortly after seized with

* Taylor's Med. Jurisprudence, p. 308.

insensibility, dilated pupils, oppressed breathing, and died without any return of sense. The bone and the brain beneath the injured part were examined and found natural. The mucous membrane of the cardia, and the upper part of the stomach, were greatly inflamed; the other parts were not diseased. Before the court, Drs. Hartshorne and Klapp gave it as their opinion that the injury to the head had not been the cause of death, and that there was no appearance of a blow on or near the region of the stomach. The accused was accordingly acquitted.*

Mr. Shaw mentions the following instructive case in his *Manual of Anatomy* :—

An industrious man returning home from his work, found his house empty of everything, his bed and the tools of his trade sold for gin by his wife, whom he found in the gin shop, drinking and dancing. He brought her home, and in the passage of his house struck her, and ordered her to go up stairs. She refused; he carried her up on his shoulders, and the contention continuing up stairs, he struck her again. There having been no one present, we have only the husband's account of her death. He said, that while sitting on her chair she fell down, upon which he threw her on the bed, conceiving she was in a fit, such as he had seen her in formerly. Some of her neighbors coming in, found her dead.

Sir Charles Bell examined the body, and on the trial gave the following deposition :—

There was nothing remarkable in the abdomen and thorax, farther than that the stomach contained a quantity of gin, and there was a blush of redness on the lower orifice of the stomach and duodenum. On the head there were several bruises, but the bone was not at all hurt, and no extravasation appeared under it. The vessels of the pia mater were empty of blood, as if from pressure. There was a serous effusion under the

* This case is given by Dr. Klapp, in *American Medical Recorder*, vol. i. p. 156. A similar state of the stomach is found in cases of apoplexy, as shown by Professor Warren in his dissections. *New England Journal*, vol. i. p. 34. And it is possible that it may also follow from blows on the head; but in the present instance, after the dissection, there can be hardly a doubt that it should be ascribed to the first, rather than to the last.

arachnoid and in the cavity of the brain, similar to what has been found in those who died of intoxication. On the surface of the brain, there was what appeared to be spots of extravasated blood, but upon tracing them toward the base, they appeared to be streams of blood which had flowed from a vessel ruptured in the base of the brain, and the base was covered with coagulated blood, in which also all the roots of the nerves were involved. The blood had penetrated into the ventricles by perforating their floor; and on removing the brain and tracing the vessels, the anterior artery of the cerebrum, going off from the internal carotid of the left side, was found half torn across, and from this the extravasated blood had come.

Now this rupture had been the cause of death; and as to the cause of rupture, "Mr. Bell's opinion coincided with the best authorities in pathology, that there is a state of the vessels, in which an external injury or shock is more apt to produce rupture; and drunkenness may be supposed to be the artificial state of excitement which most resembles this state of the vessels. Being asked whether the blows were the cause of the rupture, he said he conceived it very likely that a shock would rupture the vessel; and being then asked, whether he conceived that this woman was more likely to have a vessel ruptured from having been intoxicated, he was of opinion, that intoxication and the struggle were likely to produce such a degree of activity of the circulation in the head, that a less violent blow might produce rupture, than what, in other circumstances, might have proved fatal."

The man was acquitted.*

* Manual of Anatomy, vol. i. p. 46. Mr. Shaw adds that a case similar in many respects, occurred some time previous, but the man was condemned upon clear evidence of his intention to commit murder. A parallel case to the one in the text is given in the *Medico-Chirurgical Review*, vol. iv. p. 969, from a French journal. The drunken quarreler fell dead without a blow, and, on dissection, enormous extravasation was found in the brain. See also, *Dictionnaire des Sciences Médicales*, art. *Ivresse*.

It may, however, be urged, that the tendency of the remarks in the text is to exonerate all and every one from the consequences of injuries inflicted on the intemperate. Not so: if these injuries are recent, and if they cannot be confounded with the effects of natural disease, they are to be estimated like all other wounds. Severe blows, followed rapidly by convulsions, coma and

There are some instructive German cases which may be briefly analyzed:—

A man was struck for misconduct, by a magistrate, twice on the face with the flat of his hand,—once slightly, and once pretty severely. No ecchymosis or swelling followed. On the next day he went to his usual work, but complained of his head. It was not until the thirteenth day that he sought for medical advice; he then complained much of his head, and attributed the pain to the blows received. Medicines were given, but the next day he had occasional fits of excruciating pain, and on the fourteenth day from the time he was struck, he died somewhat suddenly. On dissection, no traces of fracture or extravasation of blood could be discovered; but connected with the dura mater, on the posterior surface of the petrous portion of the right temporal bone, there was a round tumor about the size of a hazel nut, and which was found to contain a few drops of yellow-colored pus. The tumor was attached by a small peduncle to the bone, but the bone was not diseased, nor were there any signs of redness or inflammation in the parts around. The thorax and abdomen were healthy. The medical inspectors gave it as their opinion that this fungus could not have arisen from the violence used fourteen days before death, but on the contrary, that it must have been of several months' growth. In the absence of all symptoms of

death, and exhibiting, on dissection, effusion of blood upon the brain, without any other disease of that part, present a very conclusive case of the effects of violence. Such an instance is related by Mr. Watson, in the *Edinburgh Medical and Surgical Journal*, vol. xxxvii. p. 97.

This subject, in all its bearings, has been well considered by Mr. Taylor, (*Medical Jurisprudence*, pp. 401 to 420.) There can be no doubt that in too many instances counsel, taking advantage of the admissions of medical witnesses, lay undue stress on the effect of mental excitement in producing *rupture of vessels*. And it is erring against the first rules of reasoning to suppose a minor cause to be the means of this, when a more powerful one (the blow) is known to have been applied. The point to be distinctly brought before the court and jury cannot be better stated than in the words of Mr. Taylor. Was not the violence inflicted sufficient to cause death under the same symptoms and post-mortem appearances, within the same period of time, in an individual perfectly *sober and unexcited*? If this be answered in the affirmative, there would still be room left for the ingenuity of counsel to urge mitigating circumstances in each particular case.

concussion or inflammation, and with the ascertained facts that the deceased had complained of pain in the head for more than a year, that he had been of irregular habits and engaged in many quarrels, they totally acquitted the magistrate of all responsibility.

In another instance, an individual was severely beaten on the head and chest, and a slight hemorrhage followed from these injuries. This was on the 6th of January, 1835. He seems to have been ill for some days after this, but nothing was known of his condition until the 8th of April, when he was evidently laboring under diseased lungs. He lingered until the 7th November, when he died, *ten months* after the receipt of the injuries which it was alleged had caused his death. On dissection, the right lung was seen filled with tubercles in various states of softening and suppuration. The left lung presented traces of inflammation and strong adhesions, and in its upper lobe was an abscess containing much matter. It was thus evident that he had died of phthisis. It also appeared that he had been in good health up to the period of the maltreatment. The question thus arose, how far the fatal disease might have originated from the injury? It was urged that no mechanical injury had been done to the chest sufficient to account for the production of phthisis, and that the inflammation in the left lung might have been the simple accompaniment of tubercular disease. The morbid appearances indicated phthisis of long standing. In conclusion, death was ascribed to phthisis proceeding from constitutional causes, the fatal effects of which had probably been accelerated by the ill treatment, as well as by the want of proper medical assistance for a long period afterwards.*

* British and Foreign Med. Review, vol. vi. p. 540, from Henke's Zeitschrift, 1837. The editors, in commenting on this case, seem to hold a somewhat different opinion: "There is no doubt," they say, "that in this case, death was due to phthisis and not to the violence used; the same amount of violence applied to a non-phthisical subject, would probably have been attended with no serious effects. We cannot look upon phthisis as even likely to be a secondary consequence of mechanical injury to the chest, unless there existed a strong tendency to the disease. The appearance of phthisis under these circumstances, ought to be regarded more as a coincidence than as an effect."

[The following case illustrates very strikingly the danger of making rash conclusions. A. B. was stabbed with a pen-knife over the left heart, the cavity of the thorax was not penetrated. Symptoms of pleurisy followed, and he died on the tenth day. On post-mortem examination, intense inflammation of the pleura, and in a less degree of the lung, was discovered, but confined to the right side. The superficial wound had healed. —C. R. G.]

Again, there are certain diseases which frequently accompany wounds, yet also arise independently, and which may thus cause matter of doubt. Of these, I will only specify erysipelas and tetanus.

"Erysipelas," says Sir Astley Cooper, "often succeeds the most trifling injury of the scalp, and like carbuncle, when it occurs in this situation, generally destroys life. *Whatever renders the body irritable predisposes to it.* The slightest causes produce it after operations at certain seasons and in particular states of the constitution, for it has often happened that the stimulating effects of adhesive plaster have produced this disease, and have led to the death of the patient."*

Taking these as undisputed facts, what should be the testimony of the physician in cases where it supervenes on blows or wounds?

1823, a prostitute at Edinburgh entered the house of a female brothel-keeper, in a state of drunkenness, and, after various irregularities, inflicted on her with a heavy smoothing-iron a denuding wound of the scalp, an inch and a half long. The woman was slightly stunned, and the wound bled profusely. Very little evidence was obtained concerning her state for thirty days afterwards, but at that time the wound was an open sore, and she constantly complained of headache. She had not, however, omitted the habit of frequent intoxication, and was at a ball about a fortnight before her death, where she danced and became drunk. Eight weeks after receiving the wound, she was attacked with erysipelas of the head and scalp, and died of it in ten days. There was no proof to show where the erysipelas began, as the practitioner who attended

* Lectures, vol. i. p. 112.

had gone to sea. On dissection, the ordinary appearances produced by that disease were found in the scalp, and within the cranium; the wound had passed into the state of a round, indolent ulcer, and a small hole, produced apparently by ulcerative absorption, penetrated the skull opposite the middle of the ulcer in the integuments. The hole was widest at its inner end. The dura mater corresponding with it was not diseased, and no purulent matter was deposited between that membrane and bone.

On these facts referring to the irregular habits of the female, the probable neglect of the wound, and above all, the presence of an epidemic erysipelas at the time in Edinburgh, the medical witnesses declared that the death of the deceased could not, with any certainty, be ascribed to the wound inflicted by the prisoner. The charge of murder was consequently abandoned, and the accused was found guilty of the assault.

It is remarked by the reporter of this case, that an important link of the testimony was lost, in not knowing where the erysipelas commenced. "The diagnosis between idiopathic erysipelas and that symptomatic variety which supervenes upon injuries of the head, is sufficiently simple. The former never begins, so far as we know, on the head, but always on the cheek or tip of the nose; the latter, never but about the bruise, incision, or sore produced by the injury."*

Respecting tetanus, there can be comparatively but little diversity of opinion. It is a disease known to follow injuries of every description, and if it supervenes after such infliction, is, without some manifest and potent reason, to be deemed its consequence. Mal-treatment is more likely to be urged in such cases, and the attending surgeon's skill may thus be questioned.†

* Trial of Christian Paterson for the murder of Margaret Baird. (Edinburgh Medical and Surgical Journal, vol. xxi. p. 488.) MS. communication of Dr. Dunlop containing the medico-legal examination. [The pathological views given above, as to the starting-point of erysipelas, are not now held correct; the disease may originate spontaneously on the head, and it may arise afterwards on parts remote from the injured points.—J. W.]

† [It would be difficult to say what sort of mal-treatment could produce tetanus; spasm may follow the use of nux-vomica, but that is not tetanus.—J. W.]

Not long since, Captain Moir, in England, wounded a man by firing at him with a gun. The ball penetrated the inner side of the right arm, a little below the elbow, and passed out on the outside, a little above the olecranon. A profuse hemorrhage followed, but soon ceased. No bone was fractured. The surgeon called administered some brandy, as the man was faint. In a short time excitement took place, for which he was bled, but locked jaw followed, and he died on the eighth day. On the trial, Captain Moir was found guilty, and probably with great justice.*

It was urged by Dr. Venables, in a communication on this case, that the administration of the brandy was improper, and might have caused the tetanus equally with or instead of the wound. Such an opinion, however, is hardly tenable.† There was no dissection.‡

* If, however, Capt. Moir was probably insane, as is suggested in the Edinburgh Med. and Surgical Journal, (vol. 1. p. 513,) the nature of the case is materially altered.

† London Medical Gazette, vol. vi. pp. 750, 791; Medico-Chirurgical Review, vol. xviii. p. 151. Dr. Venables criticized the treatment in other respects.

‡ There can be no doubt that diseases of internal organs sometimes succeed injuries of various parts of the body, and also operations. In illustration, I refer to Dr. Rose's paper on *depositions of pus and lymph, occurring in the lungs and other viscera, after injuries*, in the Medico-Chirurgical Transactions, vol. xiv. p. 251. He quotes Morgagni and others, and there is a case by Deveaux in 1685, noticed by Chaussier, p. 208, where the surgeons directly ascribed an abscess in the liver to a previous blow on the head. Dr. Darwall's remarks, subjoined below, are well worthy of consideration:

"The circumstances of depositions of pus occurring in the viscera from injuries of distant parts, has lately been attracting considerable attention. It is, however, scarcely alluded to in the text; nor, with a few exceptions, have surgeons usually regarded such depositions as connected with or induced by the injury. In the present note I purpose to show the various circumstances under which this has happened, but without offering any explanation. The cases have, however, been too uniform to admit of a doubt of the visceral disease being the consequence of the distant injury.

"Morgagni relates some cases in which *the lungs were found in a state of suppuration after the injury of the head*.

"A boy, thirteen years of age, was struck on the right temple with a stone. He was carried to a hospital, and went on well till the fourteenth day, when fever ensued. The wound assumed an unhealthy appearance, he became delirious, and died on the twenty-fifth day from receiving the injury.

"On examination, besides the injury of the head, the lungs were very red,

In 1827, a man at Edinburgh robbed another, and, in the scuffle that ensued, kicked him several times, cut his nose with

and small abscesses filled with pus were observable. (Morgagni Epistol, li. p. 18.)

"A second case is related, in which, after a similar injury, the lungs exhibited many small abscesses, and some tubercles in their progress to suppuration.

"The following case will show how these cases will bear upon medical jurisprudence. It is taken from the evidence at an inquest which was held at Birmingham last year:—

"A father and son were working together at an anvil, when the son, a boy of fourteen years of age, missed his aim in attempting to lay hold of a piece which the father had forged and cut off from an iron rod; while the boy was stooping to pick the piece up, the father knocked him down by a blow on the head with the remaining part of the iron rod. He fell down, and his head bled much; he was, however, able to walk to the hospital, where the wound was dressed, and back again home. This occurred on the 23d of July; on the 10th of August a surgeon visited him for the first time, and found him apparently in the last stage of typhus fever. He died on the 12th.

"On dissection, there was considerable injury about the scalp, and matter had formed under it. There was no fracture, but matter had also formed under the dura mater, and the left hemisphere exhibited appearances of inflammation.

"In the chest 'the lungs were very much condensed, and like liver in consistency: they were inflamed, and there were three or four abscesses of recent formation. The pleura was covered with lymph; the left cavity of the chest contained a quart or more of fluid, and the right nearly as much.'

"The medical witnesses did not decide which was the proximate cause of death, nor whether the state of the lungs had any connection with the injury of the head, and the verdict was—'That the deceased died after a blow from his father; but whether from the effects of the blow or from disease there is no evidence.'

"Injuries of the head also frequently give rise to abscesses in the liver.

"Bertrandi, in the 'Mémoires de l'Académie Royale de Chirurgie,' relates several instances of this kind, and states that he had frequently observed suppuration of the liver when it was least expected. In some cases there is evidence of affections of the liver before death, and jaundice occurs, but this is not always observable.

"A peasant, forty years of age, was admitted into the hospital at Turin for a wound in the head, which penetrated to the dura mater, and remained two months. He left the hospital in June, and returned to his usual agricultural employment. Toward the end of July he was readmitted; his face, neck, and the upper part of the trunk were enormously emphysematous; his face was marked with erysipelatous patches; his respiration was difficult, and he died in a few hours. There was nothing particular found about the head, but there was an immense abscess pointing on the convex surface of the liver. He was reported to have been jaundiced some days before, and to

a blow, and turned him out of the house. The injured person went home, told his friends that he had been "robbed and

have alternated between a state of stupor and delirium. He had complained of a feeling of weight in the side, but never of pain.'

"The liver and lungs frequently suffer from injuries of other parts."

"An athletic man was admitted into the hospital on the 23d of June, under the care of Mr. Keate, with compound fracture of both bones of the right leg, a little below their centre. He went on well till the 26th, when he became feverish; a distinct rigor appeared on the 30th, and in a few days tenderness in the epigastrium and right hypochondrium occurred. The remedies employed failed to relieve him: he gradually became worse, and died on the 17th of July.

"Sectio cadaveris."—There was a little opacity in the tunica arachnoides, with some deposition of lymph. The plexus choroides was converted into a tubercular mass of gland-like appearance.

"The chest and abdomen presented the principal marks of disease. The pleura on the right side was intensely inflamed, and serum and pus were collected in its cavity. On the left side the membrane was also inflamed, and serum and lymph, but no pus, were discovered. In the substance of the lungs, more especially the left, were tubercular masses of mixed lymph and pus, numerous and varying in size. In the liver were the same sort of tubercles, exceedingly numerous, and seated for the most part immediately beneath the peritoneum investing the viscus. (Medical Gazette, vol. ii. p. 510.)

"In another case of simple fracture, which terminated fatally almost a month after the accident, 'innumerable depositions of lymph and pus had been formed in the liver and the lungs.'

"The following case, quoted from the same periodical, exhibits a deposition in the liver and right knee-joint after an operation for urinary fistula. It is extracted from the *Ephémérides de Montpellier* for March, 1828: 'A soldier, aged twenty-two, was affected with yellowness of the skin, with tension of the right hypochondrium, after an operation for urinary fistula which had given him great pain. The symptoms disappeared when the sound was removed from the bladder, but returned on its being again introduced into the urethra. He was seized with nausea and bilious vomiting, yellowness of the skin, excessive tenderness of the right hypochondriac region, irregular rigors, and violent pain of the right knee. He died. The liver was found studded with purulent deposits, and generally softened; a collection of pus was found in the right knee-joint.' (Medical Gazette, vol. ii. p. 668.)

"A case of purulent deposition in the lungs after amputation is given in the same journal. The limb was amputated in consequence of a severe compound fracture. The man was in perfect health at the time of the accident.

"Depositions of pus in the lungs have been found likewise after inflammation of the veins, some cases of which have been lately reported by Mr. Arnott.

"The spleen occasionally suffers in the same manner.

"The following description of the appearances observable in such cases, is given by Mr. Rose, in the fourteenth volume of the *Medico-Chirurgical*

murdered," and was confined for several days to his bed. He was not, however, considered in danger. On the third day he complained of stiffness of the jaws, contraction of the mouth, and great difficulty of swallowing. He went out, however, to

Transactions. The paper in which it is contained deserves a very attentive perusal:—

"The disease consists apparently of depositions in the cellular texture of the affected organs, partly of a white or yellowish-colored lymph, and partly of pus. These depositions vary in size, from beyond the bulk of the largest walnut to something less than a common pea. Where the lymph is most abundant, they may be described as a soft, white tubercle, of irregular shape, not contained in a cyst, but imbedded in the cellular substance of the part, and gradually blending with its natural structure. When pressed, some pus exudes from them. Where the pus collects in greater quantity, it is lodged in an irregular cavity, probably in the middle of some of the tubercles, and the walls of the abscess are formed of flakes of lymph. The number of these tubercles and abscesses vary in different instances, there being sometimes only one or two, and sometimes the whole viscera being filled with them. In the lungs they are chiefly formed in the parts adjacent to the pleura pulmonalis; and there is often at the same time an effusion into the cavity of that membrane of a sero-purulent fluid mixed with lymph. In the liver and spleen they are dispersed throughout the substance, sometimes showing themselves in one or more yellow patches, not elevated, on the convex surface of the great lobe of the former viscus, and at other times lodged in its substance. The parts adjacent to them show evident marks of increased vascularity."

"Several other cases have been noticed in Birmingham, within the last few months, of a similar kind. They have chiefly been discovered in the bodies of persons who had been killed, and upon whom inquests were held. In one instance of this kind, where death occurred within forty-eight hours, from receiving an injury of the head in fighting, the lungs were gorged with blood, and the pleura exhibited extensive marks of very recent inflammation."—DARWALL.

Mr. Travers entertains a similar opinion with Mr. Rose and other writers on this subject; but it is suggested whether, in some cases, internal injury might not have been the cause of the internal disease—this occurring at the same time as the fracture or wound. (*British and Foreign Medical Review*, vol. ii. p. 10; see also Nasse on Secondary Abscess, *ibid.*, vol. iii. p. 502.)

This subject has been carefully investigated in "Historical notices on the occurrence of inflammatory affections of the internal organs, after external injuries and surgical operations, by Wm. Thomson, M. D." (*Edinburgh Med. and Surg. Journal*, vol. lii. p. 392.) The author has brought together a large collection of facts. See also Erichson on Pneumonia, as a consequence of surgical operations or injuries. (*London Medical Gazette*, vol. xxvii. p. 794.)

[See also "An Inquiry into the pathology and treatment of secondary abscesses, and other constitutional diseases, resulting from injuries and surgical operations. By Jno. Watson, M. D." *American Journal Med. Sciences*, November, 1837.]

work two days after, but in forty-eight hours became so unwell as to return home. He was so ill with the stiffness that he could hardly swallow a little spoon meat. The disease increased, and he died on the eleventh day after the injury.

On dissection, there was found a small, lacerated wound upon the nose, at the lower extremity of the suture which unites the nasal bones. The internal parts were generally natural, except that the posterior part of the fauces was of a dark-red color, from congestion of the vessels of the lining membrane; and a similar appearance was observed in the membrane lining the air-passages.

The medical witnesses (Messrs. Newbigging, Liston, Watson, etc.) gave it as their opinion that the deceased died of tetanus, occasioned by the wound. On being questioned whether the going out of the patient might not have been the cause, they replied that the symptoms on the third day were proof of the disease being already present. Lockjaw from cold was very uncommon in Scotland, and he had not left the house until the fifth day.

The charge of murder was abandoned by the public prosecutor, because the injuries received were not of a mortal nature; nor had they been inflicted with a design to commit murder. And the prisoner was found guilty of culpable homicide, and sentenced to fourteen years' transportation.*

Another question bearing on this division of our subject, has been distinctly propounded by Mr. Taylor. *Whether, when death takes place from an operation indispensably necessary and skillfully performed, after a wound, the prisoner is to be held responsible?* A direct decision would appear to have been evaded in several criminal cases. I shall, however, hereafter quote an instance under the head of poisoning by sulphuric acid, in which phlebitis ensued from venesection, and the patient died in consequence, and yet the prisoner was convicted on the main charge. Here the opening of the vein was, in the opinion of several physicians, necessary to remove, if possible, the effects of the poison.

* Edinburgh Med. and Surg. Journal, vol. xxxvii. p. 95; Syme's Justiciary Reports, p. 158.

I cannot doubt but that, with the restrictions above named, the prisoner should be held responsible.

2. The passions of the patient, and his negligence or delay, or that of his attendants, may render slight wounds dangerous, or dangerous ones mortal. This may happen, 1. By his obstinate refusal to undergo the proper treatment, either from fear or some other cause. 2. From errors in regimen, such as intemperance, from exposure in a very cold or a very warm place, or from giving himself up to the free indulgence of his passions. 3. By disobeying the directions of his physician, as for example, if a man who has been wounded in the throat should laugh, talk, or sing. 4. By yielding to anger or fear, so far as to tear off the bandages and dressings of the wound. All these circumstances will aggravate an injury and render it dangerous or mortal.* There are others which may be deemed accidental causes, such as want of proper aid, of whatever kind it may be, and from whatever source it may arise. Both of these, of course, increase the guilt of the criminal, if it can be proved that he inflicted the wound with a knowledge of them. To this class also belongs every obstacle opposed to the surgeon's performance of his duty, and all attempts to disturb the patient, such as the prevention of sleep, and producing agitation of mind.

A curious case occurred at Montpelier in 1833, which I prefer noticing under this head, although it might probably be equally well considered under the former:—

On the 12th of May, Charles Crés received a slight blow on the head; he became indisposed on the 14th, and a serious illness finally developed itself, of which he died on the 20th. The physicians in attendance certified that there had been a slight contused wound on the right parietal bone, and they were of opinion that this was the cause of the headache and other severe symptoms that followed. They had no doubt that inflammation of the brain was present, and that this had given rise to the gastro-intestinal inflammation which succeeded it.

On dissection, however, *no mark of disease could be found in the brain—its vessels, or its membranes, or its bony covering.* The

* Mahon, vol. ii. p. 28.

contused wound was superficial, not extending even through the integuments. The ventricles contained but a small quantity of serum. The lungs were, however, extensively diseased; crepitus was wanting in several portions, and on cutting into them, a large quantity of dark blood was discharged. The other parts were generally healthy.

These counter reports were submitted to the professors at Montpellier, for their opinion. They agreed that death was not attributable either to concussion or compression of the brain, nor to inflammation of its substance or envelopes. None of the symptoms of the first two were at any time present. Indeed, Crés, immediately after receiving the blow, was so little affected as, in his rage, to collect stones for the purpose of hurling them at his antagonists. No indication of compression could be shown, nor was a single mark of inflammation present. But could not this last have disappeared after death? They answer, no; death does not dissipate the marks of recent inflammations.

What, then, was the cause of death? Undoubtedly an inflammation of the lungs. He had been subject to this previously, and it is probable that *anger, fatigue, and probably intemperance*, all united in predisposing to the attack.

The professors, therefore, decided that the injury could not be deemed the *direct* cause of death, although they conceded that, under the circumstances, it might be deemed what physicians call an *occasional* one, resembling in this the fatality that sometimes follows from slight or minute injuries. It is almost needless to add that the charge of murder was abandoned.*

3. Insalubrity of the atmosphere, whether it be of a local nature, or the general constitution, may render slight wounds dangerous, and dangerous ones mortal. This circumstance has been noticed some centuries since, and the experience of every military campaign confirms its correctness. Thus, according to Boiin, Sebezius states that wounds of the head were more readily cured in Italy and Spain, than in Germany; and Foderé mentions his having observed the same on the coast of the

* Annales d'Hygiène, vol. xi. p. 474.

Mediterranean, when compared with Paris. Ambrose Paré, a great name in surgery, observes, that at the siege of Rouen, many of the besiegers died of small and simple wounds, in consequence of the unhealthy atmosphere, but which was attributed by the army to poisoned weapons—an idea which similar effects induced the inhabitants of that city also to harbor.*

Severe cold, excessive heat, storms of rain, snow, or hail, have all been observed to increase the danger of wounds, and for proofs of this, I need only refer to works on military surgery.

The air of large hospitals has also been found injurious, and it is constantly observed that a larger proportion die of wounds in the Hôtel Dieu at Paris, than in the Hôpital de la Charité.† The very name of hospital gangrene, is sufficient to apprise us of the extent of the fatality that is sometimes experienced. In such cases, it is the duty of the medical examiner to apply the maxim of Hippocrates, that everything which happens to the injured person, contrary to correct probability, does not belong to the essence of the disease. Thus, if there is a general or local morbid state of the air, and the most cautious examination proves that the wound has not affected any essential organ, it is his duty to state these facts, and to mention that death has originated from several causes, of which the wound is the slightest, although it may have excited the development of the others.‡

* Bohn, p. 78; Foderé, vol. iii. p. 276.

† Mahon, vol. ii. p. 25. "Dans certain hospitaux, et notamment à l'Hôtel Dieu de Paris, le trepan est presque toujours mortel." (Metzer, p. 376.)

See also Dr. Chevers on the Causes of Death, after Injuries and Surgical Operations, in London Hospitals. (Guy's Hospital Reports, vol. i. N. S., p. 78.)

‡ *Composition of confined air.* M. Felix Leblanc lately read to the Academy of Sciences of France a very interesting memoir on this subject. The author has analyzed, according to the process of MM. Dumas and Bous-singault, the air taken from many different places, and the following are the results of his researches:—

Air of green-houses. In the air collected in the evening, the relative proportions of oxygen and nitrogen were the same as those in the open air; but the carbonic acid was found to have completely disappeared under the influence of vegetation.

Air of bedrooms. In the one experimented on, there had been a fire during

4. The ignorance or negligence of the surgeon may aggravate or endanger the condition of a wounded patient.* This

the afternoon. Eight hours after it had been put out, the air showed on analysis the same composition as that of pure air.

Air of hospitals. In the ward "rotaire," at La Pitié, which had been kept shut during the night, the air contained nearly 3-1000ths of carbonic acid, or a quantity five times greater than that of pure air; the oxygen had experienced a corresponding loss. In one of the dormitories of La Salpêtrière, the air gave 8-1000ths of carbonic acid. This is the largest proportion the author has yet found in hospitals.

Air in public lecture-rooms. In the lecture-room of the Sorbonne, which is capable of containing 1000 cubic metres of air, after a lecture of an hour and a half in length, and at which 900 people were present, the oxygen was found to have lost one in every 100, although two doors were open; while the carbonic acid was rather increased in a greater ratio. This proves, in a marked manner, the utility of artificial ventilation in like circumstances.

Air in a ward in an institution for children. Although the door was half open, and there was an open space in the roof, (*visistas*,) the air was found to contain 3-1000ths of carbonic acid, and a proportional diminution of oxygen.

Air in a school-room. This room (that of the eleventh Arrondissement) was ventilated by means of an apparatus constructed by M. René Duvoir, after the method of M. Pécelet. When the room had been occupied five hours, 16-10,000ths of oxygen had disappeared, and the carbonic acid had increased to more than 2-1000ths.

Air in the Chamber of Deputies. The carbonic acid was 25-10,000ths and it is likely that the proportion would be more than double on those occasions when the chamber was twice as well filled as it was on the day that the experiment was made.

Air in a theatre. At the Opera Comique, a little before the close of the performance, the air of the pit contained 23-10,000ths of carbonic acid, and in the highest part of the theatre it even rose to 43-10,000ths.

Air in the stables of the Ecole Militaire. In one of the stables, one part in every 100 consisted of carbonic acid; and in another, 2-1000ths only of this gas was found.

M. Leblanc made a number of experiments, which prove, that animals can support, without sinking immediately, carbonic acid in larger doses than what is found in air rendered fatal by the introduction of this gas from the combustion of charcoal. We must then seek for other causes to explain the violence of the effects seen in this latter case.

We ought to admit, as experiment has proved, that the quantity of carbonic acid in close and confined situations, and which is almost always appreciable, should increase according to the presumed degree of insalubrity. The greater the quantity of carbonic acid, the more is the necessity for a renewal of the air; and respiration cannot be carried on in a normal manner if it

* Bohn, pp. 93, 96.

happens when futile or injurious medicines or applications have been used, when the instruments employed are in bad order,

exists in the proportion of one part in 100. From the experiment of M. Pécelet, from six to ten cubic metres of air are required per hour, in order that the respiration be carried on in the usual way. These partially agree with M. Dumas' experiments on respiration. In places which are inhabited, and which have no proper apparatus for ventilation, and are without chimneys, the air is renewed very imperfectly by the joints in the doors and windows, and only twice as well as in a room completely closed. Life cannot be prolonged beyond a few moments, where the atmosphere contains thirty parts of carbonic acid in every 100. The higher the natural temperature of an animal, the less can it resist the asphyxia from carbonic acid. There is no decisive experiment on the degree of alteration which the air must undergo before it becomes asphyxiable by the burning of charcoal. M. Leblanc has shown, that an atmosphere containing three or four of carbonic acid in every 100 parts, proved suddenly fatal to a large dog. This was totally independent of temperature, and death took place before a candle ceased to burn. (Lond. and Edin. Monthly Journ. Med. Sci., and Gazette Méd. de Paris, 11th June, 1842; Amer. Journ. Méd. Sci., N. S., v. p. 495.)

On the Composition of Pure and Vitiated Atmospheres. By R. D. Thomson, M. D., Glasgow. (Proceedings of the Glasgow Philosophical Society.)

Dumas has lately published some experiments made at Copenhagen, on air taken from the surface of the ocean. Its constituents were found to be the same as those already obtained from every kind and description of place, under ordinary circumstances.

The quantity of carbonic acid in the atmosphere in its pure state has been shown by Saussures to vary from three to six parts in 16,000. But Leblanc found that the air [as stated above] in one of the wards of the hospital "La Pitié," which contained fifty-four patients, afforded five times more of carbonic acid than in healthy air. So also in one of the dormitories of the Salpêtrière it reached to nearly fourteen times more. In Dumas' class-room, after a lecture of an hour and a half, where nine hundred persons were present, the carbonic acid amounted to one per cent., and the same quantity of oxygen had disappeared. From other experiments, he considers this the maximum quantity for safety, and strongly recommends a better ventilation, when so much carbonic acid is present. This result agrees with experiments made in Great Britain. When the atmosphere is deteriorated by burning charcoal, he has seen death produced when three per cent. of carbonic acid was present in the atmosphere. In all such cases of death from stoves, he has found carbonic oxide in the air, and he attributes a deleterious effect to the agency of this gas. He has observed one per cent. of this gas to destroy an animal in two minutes, which is contrary to the statement of M. Nysten. This observation explains many of the inconsistencies which appeared some years ago in the evidence of some London chemists, respecting the influence of Joyce's stoves. It is quite obvious that their structure was dangerous. Leblanc found that a candle was extinguished in air containing four and a half, or six per cent. of carbonic acid. In such an atmosphere life may be

when the surgeon is either ignorant or rash, or when, seeing the danger, he does not obtain aid of skillful persons. In

kept up for some time, but respiration is oppressive, and the animal is affected with very great uneasiness. Air expired from the lungs contains about four per cent. of carbonic acid, thence this atmosphere is noxious. Even three per cent. in the atmosphere killed birds, and yet we have seen statements which affirmed that upwards of three per cent. had been detected in the London theatres. All these facts are pregnant with importance in reference to health. Our miners may not be suffocated by fire-damp explosions, but we should remember that their constitutions may be poisoned by the respiration of tainted atmospheres. (Lancet, February 4, 1843.)

Carbonic acid. At the late meeting of the British Association, the secretary read a "Report on Poisons," by Dr. Roupell. After alluding to his former communications on the same subject, the author stated that he would in this report confine himself to some views on carbonic acid, an agent of the highest interest, from its injurious effects when applied in any way to the human frame, from its immediate connection with the function of respiration, and from the analogy of its effects to some serious maladies. The effects of carbonic acid, when not eliminated from the lungs, he stated were much overlooked, while the action of other substances less deleterious had been much attended to of late. This gas was eliminated, not only by the lungs, but also by the skin, by the serous and mucous surfaces, and that its quantity was much affected by many circumstances, more being given out by the lungs by day than by night, increasing by daybreak and diminishing at sunset; it is also increased by exercise and during digestion. It is lessened by depressing passions, by debilitating causes, by low diet, and injuries to the *par vagum*. The effect of the gas, when injected into the veins and arteries, were detailed in experiments. When two ounces (by measure) were injected into the saphena vein of a dog, the animal uttered cries of distress, became convulsed, lost its consciousness, and appeared to be dying. It felt, however, the stimulus of cold water, and recovered when thrown into the fresh air. When an ounce and a half were injected into the carotid artery, the animal became convulsed and foamed at the mouth; after forty minutes it seemed to recover, but again relapsed, lost all consciousness and power of movement, was quite insensible, and lay, as if dead, upon the floor. At intervals of a few minutes, it was seized with violent spasms. This alternation of stupor and convulsions continued for four hours, when the animal regained its senses and the power of its limbs, appearing to suffer no inconvenience. From these experiments, and the well-known symptoms produced by its inhalation, the author concludes that the gas is intrinsically poisonous, in opposition to the opinion of M. Nysten and others, who deemed it negatively injurious, acting in the same manner as common air when injected into the blood-vessels, and by its exclusion when inhaled. The author alluded to those diseases, the leading symptoms of which resembled the effects of carbonic acid, and stated them to be such as prevented the proper arterialization of the blood, such as emphysema of the lungs and diseases of the heart: but the disease which most nearly resembled its action, and appeared its true proto-

general, when a dissection proves that no wound, mortal in its nature, has been received, and when none of the circumstances

type, he stated to be epilepsy, which was produced with all its terrors and depressing consequences by plunging an animal into this gas, which appears to act on the medulla oblongata, for it annihilates volition and consciousness, which have their seat in this portion of the nervous centres, and is also the source of respiratory movements, which the author conjectures may primarily and through life be excited by the stimulus of carbonic acid, and that the phenomena exhibited by narcotic poisons may depend on it. He has long laid it down as a rule, that opium is not to be exhibited, when the blood is not properly aerated or decarbonized; he also proved, by direct experiment, that the quality of carbonic acid given out by the lungs is much increased when opium begins to exercise its characteristic effects on the system. In conclusion, Dr. Roupell stated that the ideas expressed in this paper were stated with great deference to the meeting, and were advanced with the view of calling attention to certain interesting but obscure phenomena. (Athenæum, Aug. 24, 1841.)

Asphyxia.—Sudden death and its causes. By Marshall Hall, M.D. The slightest addition of carbonic acid to the atmosphere presents the impediment to the *diffusion* of this acid from the lungs, and to the *equivalent absorption* of oxygen gas, and *asphyxia* may be said to commence. A certain proportion of carbonic acid in the atmosphere would produce asphyxia as completely as submersion itself, by totally arresting the diffusion and absorption processes. It is this principle which must guide us in the investigation of asphyxia from charcoal fires, etc. By pursuing this we shall be able to establish the influence of the carbonic acid retained in the blood, in its poisonous agency on the different organs.

When we compare the duration of life when an animal is made to respire pure nitrogen or hydrogen with its speedy extinction in the case of submersion or suspension, we can scarcely resist the conclusion that the exhalation of carbonic acid is a far more immediately vital process than the absorption of oxygen, a conclusion which we should certainly not regard, in the first instance, as a most probable one.

The question is, in other terms, whether the ingesta be more constantly necessary to life, or whether the egesta, if retained, be more poisonous or destructive?

An animal will live many minutes in pure nitrogen, deprived of the stimulus of oxygen; but if the separation of the carbonic acid in the lungs be arrested, the vital powers are speedily extinguished by the poison.

The privation of food may be sustained for several weeks; it is pure inanition; but suppression of urine, of bile, of the secretion of the fæces, is fatal in a much shorter space of time, the egrenda, if retained in the blood, proving, like the retained carbonic acid in cases of asphyxia, positive poisons to the vital organs. Next to the excretion of carbonic acid in the lungs, that of the urine by the kidneys is the most important. If either be defective, dozing, followed by coma, and convulsions, and death, takes place. In albuminous urine we have cerebral or true spinal attacks, hemiplegia, or epilepsy.

already enumerated can be urged as causing its fatality, the death of the patient should be attributed to the surgical at-

The whole question is one of the deepest interest in a hygienic and jurisprudential point of view, and well worthy of attention and investigation on the part of the younger portion of my audience. I have myself long meditated an investigation of the subject.

Secondary asphyxia. The danger is not altogether over when the patient appears to be restored from the state of asphyxia. The respiration and the other functions may proceed nearly naturally for some time, for some hours even, and sudden convulsions may seize the patient, and death may ensue. The blood apparently remains poisoned. Time, as in so many other cases, is an important element in the perfect restoration to health.

It will be remembered that Sir Humphrey Davy was seized with alarming symptoms on the evening of the day on which he had breathed the carbureted hydrogen gas. A soldier was taken out of the Thames in a state of asphyxia. Animation was restored, but many hours afterwards he was seized with convulsions, and expired.

From these and other similar facts we may deduce the conclusion that our watchful care and our remedies must be continued after apparent danger is over. There is a more hidden danger, the consequence of the venous condition of the blood, still ill arterialized—secondary asphyxia.

The patient should be kept in a free, cool, atmosphere, and be made to take free and deep inspirations, and active exercise should be enjoined, in order that the blood may be both freely circulated and aerated.

Sudden death. Many facts induce me to believe that the cases of *sudden death* arise chiefly from interruption of the coronary circulation. Ossification of the coronary arteries, by impeding the flow of the coronary blood, produces the transient or the permanent cessation of the heart's action and its consequences—syncope or death. But this is not the only disease of the heart which arrests the coronary circulation. In a case presenting most accurately the symptoms of angina pectoris, and terminating by a predicted sudden dissolution, a fatty condition of that organ was the only circumstance which presented itself, on a post-mortem examination, to explain the phenomena. The adeps probably compressed the coronary arteries in their course. It is probable that syncope and sudden dissolution occur in other diseases of the heart, especially dilatation, from interruption of the coronary circulation.

It is rarely that *disease*, either in the lungs or brain, induces *sudden death*. Asphyxia is promptly fatal. And some diseases within the cranium are still more promptly so. But in the latter case the disease has extended its influence beyond the cerebrum and affected the *medulla oblongata*. Sudden hemorrhage within, or adjacent to the medulla oblongata, or so situated, or in such abundance as to compress this organ, may induce death as prompt as that of asphyxia itself, with which it is indeed identical.

Instead of referring *sudden death*, therefore, with Bichat, to the heart, lungs, and brain, I am disposed to refer that fearful event, in every case, to arrested coronary circulation, or to lesion of the medulla oblongata.

tendant rather than to the author of the wound, provided it be proved that he neglected the sick person, or maltreated him, by leaving foreign bodies in the wound which might have been taken away, by not suppressing hemorrhage, by not evacuating collections of pus when necessary, by employing tents

Less sudden death may be induced in the manner described by Bichat. 'The heart, the lungs, and the brain may, in this sense, be the "trepied de la vie," and the blood may be said to be borne upon that tripod.

Less sudden death still is induced, if the stomach and intestines, the brain, the kidney, be morbidly affected. These organs are only less essential to life *in degree*. Rupture of the intestine is immediately marked by the sinking or slowly dying state. (Gulstonian Lectures, London, 1842.)

Temperature of the body after death. It is, probably, a prevalent opinion, that the body after death soon acquires the temperature of the surrounding air, particularly if it be lightly covered. However true this may be as to the external parts, it would seem, from the observations of Dr. John Davy, to be far otherwise in the internal organs, even many hours after dissolution. The following abstract is obtained from a paper in his "Researches Anatomical and Physiological," and it may be of some use to examiners in deciding how long since a body has been dead.

The first table relates to deaths that occurred in the British Military Hospital, at Valetta, in the Island of Malta, in 1828 and 1829. The subjects were all soldiers; their bodies were in almost every instance removed immediately after death to a large, airy, and comparatively cold room, and covered merely with a sheet and placed on a table of wood.

	Age.	Day of death.	Disease.	Time of examination after death.	Temperature of the room.	Temperature under the heart
1	23	Aug. 6, 1828	Acute rheumatism....	3½ hours	86°	113°
2	27	Aug. 6, "	Sudden.....	6 "	86	108
3	25	Aug. 24, "	Fever.....	4½ "	80	97
4	21	Sept. 11, "	Acute dysentery.....	4½ "	82	103
5	23	Oct. 16, "	Acute rheumatism....	14 "	69	88
6	24	Nov. 4, "	After amputation....	12 "	68	93
7	23	Nov. 8, "	Acute dysentery	3 "	66	98
9	33	Dec. 1, "	Apoplexy.....	2 "	62	88
9	23	Dec. 3, "	Consumption.....	5 "	61	90
10	28	Jan. 31, 1829	Hepatitis.....	17½ "	59	82

In No. 5, the temperature under the lobulus spigelii was ascertained, and not under the heart.

In none of the above cases, according to Dr. Davy, had putrefaction taken place. "It had hardly obscurely commenced."

That these results were not dependent on the warm climate of Malta, is

improperly, by neglecting or hurrying operations, or by not causing the proper regimen to be observed.*

Notwithstanding the distinctions that have now been made, there are some doubtful and complicated cases concerning which great difference of opinion may arise, and the skill of the surgeon often forms the disputed point. To this class most commonly belong wounds of the head, such as those, for example, in which there are no symptoms indicating the necessity of trepanning, and yet extravasation is found after death. The diversity of advice given by eminent surgeons on this point during the last twenty or thirty years, may also lead to unpleasant discussions. But it is the duty of the surgeon to acquaint himself with the most approved modes of modern practice, to apply them to the symptoms presented to his view, and then, if on examination the injury is found to be such that no efforts of art could have prevented its fatality, the death of the patient is to be attributed to the nature of his wound.†

evident from the second series of observations which were made at the General Hospital, at Fort Pitt, Chatham, England.

	Age.	Day of death.	Disease.	Time of examination.	Temperature of the air.	Temperature under the heart.
1	26	Jan. 17, 1838	Consumption.....	28 hours	30°	52°
2	19	Jan. 20, "	Pericarditis.....	16 "	40	67
3	29	Jan. 26, "	Consumption.....	18 "	40	63
4	18	Feb. 9, "	Consumption.....	29 "	43	57
5	35	Aug. 17, "	Malignant tumor.....	5 "	68	94
6	40	Aug. 18, "	Chronic dysentery...	4½ "	68	93
7	22	Aug. 19, "	Tubercles, etc.....	18 "	68	72
8	26	Aug. 19, "	Dysentery.....	16 "	72	81

In these last cases, the temperature of the brain was also frequently observed, and it averaged from five to ten degrees lower than that of the heart.

* The laws at a very early period attended to this circumstance. In the Roman code, the Lex Aquilia declared, "Si verberatus fuerit servus non mortifere, negligentia autem perierit, de vulnerato actio erit, non de occiso." So also in the ancient French jurisprudence. If negligence or bad treatment was proved, it freed the individual, unless premeditated design was established. (Foderé, vol. iii. pp. 290, 291.) The same principle practically exists in our own judicial determination.

† The principal authority used in this section is Bohn—*De Remunc. Vulner. in genere*. Foderé's (vol. ii. pp. 351 to 394,) and Mahon's (vol. ii. pp. 1 to 62,) observations are generally derived from this source.

Observations on the ordinary effects of wounds.

[Wounds, or the class of injuries included in the legal meaning of this term, are followed by disturbances of various kinds, all more or less dangerous to health or life. And, though these rarely or never all occur together in consequence of any single injury, yet when any of them do occur, they are to be considered among the natural effects of such injury, and not as mere incidental complications. From these latter, indeed, justice often requires that they should be carefully distinguished.]

These disturbances, then, in order to be well understood, must be studied collectively, in their pathological relation to the injuries giving rise to them; and the necessity for this study becomes the more obvious when we observe, as we hardly can fail to do, on the careful perusal of the cases cited by the author in this chapter, that the evidence given before courts of justice in reference to the effects of wounds, is liable to be influenced as much by the moral aspect of the questions involved as by strictly pathological considerations.

The various disturbances consequent upon injuries have no uniform order of sequence. Almost any one of them may take precedence of the others. They may alternate, or combine, according to the character of the original injury, the circumstances attending this, the condition of the patient at the time, or afterwards; without regard to treatment, and independent of extrinsic influences of which the patient can be cognizant, or over which he can have control. They may affect the vascular system, the nervous system, the respiratory apparatus, the digestive organs, the organs of secretion or excretion, the locomotive apparatus, the vital forces generally, or the functions of any organ or set of organs in the body. They may be momentary, temporary, or persistent; they may be slight or severe, embarrassing or fatal; many of them occur at the instant of the injury; some of them after an interval of hours, days, or weeks; and some of them may be deferred for months or years.

Where death is not the instantaneous result, usually among the most frequent consequences of severe injury are, in the first place, shock, syncope, and pain; in other words, nervous

depression, nervous exhaustion, and disordered nervous action; secondly, loss of blood, which may be from external or from internal hemorrhage, from the heart, the arteries, the veins, or the capillary vessels. The hemorrhage again may be primary, or that which occurs at the instant of injury; recurrent, or that which shows itself after temporary arrest, and from vessels primarily involved; or it may be secondary, occurring at an interval of several days, and after morbid actions have been established around the injured part, as erosion, ulceration, mortification, or spontaneous rupture of the vessel from which the hemorrhage proceeds.

After the first symptoms of depression have subsided those of reaction supervene, which, when irregular or excessive, give rise, in the first place, locally to sloughing or to inflammation, with its attending phenomena, suppuration, morbid effusions, ulceration, granulation, and the process of cicatrization, or healing; secondly, to constitutional disturbances, in the form of fever, which may vary in type and severity, and give rise to a numerous train of secondary ailments, either modifying the actions going on at the original seat of injury, or exciting disorder in other parts. But where the constitutional disturbance is spent mainly on the nervous, rather than the vascular system, it shows itself in the form of spasms, convulsions, tremors, neuralgic pains, paralysis, traumatic delirium, or tetanus.

The patient, surviving the second period of constitutional disturbance, may subsequently suffer from protracted and exhausting discharges, from emaciation, hectic fever, colliquative diarrhoea, scorbutic and purulent cachexia; or from persistent local ailments or disabilities, some of which terminate only with life, and some may ultimately lead directly or indirectly to a fatal issue.

To go into a full exposition of these several effects of wounds would require a volume. In this place it is necessary to touch only upon a few of them, and especially on such as are not distinctly considered in the author's text, in their direct relation to the injuries that give rise to them.

1. *Shock, and other conditions of the nervous system therewith associated.* By shock, in surgery, is meant a condition of the whole body supervening immediately after an injury, and

characterized by pallor, instantaneous exhaustion of strength, muscular relaxation, loss of animal heat, cold sweat; slow, labored, or embarrassed breathing; sighing, moaning, feeble pulse, great thirst, and sometimes involuntary discharges from the bladder or bowels; sometimes vomiting; sometimes spasms and twitches of the muscles and tendons; and where the shock is severe, protracted syncope or loss of consciousness, which may terminate in sinking and death, or gradually give place to reaction. Where the shock is not excessive, and there is neither severe pain, great loss of blood, nor serious functional embarrassment of permanent character, reaction supervenes in a few minutes or hours. But when so severe as to annihilate the nervous power, the primary shock terminates fatally by collapse without reaction. Again, where apparently slight at first, if associated with severe pain, with loss of blood or permanent functional embarrassment in any vital organ, the symptoms of shock do not disappear, the nervous power is gradually exhausted, and in the course of a day or two the patient sinks into fatal collapse. Death by collapse sometimes occurs where the patient retains his consciousness to the last, and where there has been neither pain nor loss of blood, but where the original injury has been so severe as at once to annihilate all sense of pain; for the animal frame is so organized as to be capable of only a limited consciousness of suffering. Beyond that limit the perceptive powers make no response. I have seen, after an extensive scald, the patient in profound collapse, gasping for breath, with lips blue, extremities cold and purplish, and with the stroke of the heart so feeble as scarcely to be recognized, yet capable of describing minutely the circumstances of the accident, and acknowledging that it had not for one moment given rise to pain. I have seen a patient undergo an amputation of the lower extremity while unconcernedly drinking a cupful of water, scarcely aware of the occurrence, and making no complaint of suffering, except from unquenchable thirst. On the other hand, severe and protracted pain may of itself exhaust the nervous power, and lead to fatal collapse. This I have witnessed in a child, after days of suffering, from a blister on the back of the neck.

There are other disturbances of the nervous system asso-

ciated occasionally with shock, but which are the direct result of injury to some particular portion of the nervous system: as coma and apoplectic symptoms, from injury of the brain; paraplegia, from injury of the spinal cord; local anæsthenia, or local paralysis, from injury of some particular nerve or set of nerves. But as these conditions do not depend directly on the sudden arrest of nervous influence throughout the whole system, they are to be classed among those which result from particular injuries, and not from wounds in general.

2. *Hæmorrhage.* Loss of blood, when rapid and profuse, may appear to terminate fatally before the accumulated nervous irritability has been exhausted. Here, real death will be preceded by spasmodic and convulsive throes of various kinds, which may continue from time to time to reappear, for some minutes after the heart has ceased to beat. It is rare, however, except when some very large vessel has given way, for death to follow the first gush of blood. A moderate flow usually induces syncope; this, by weakening the heart's action, and diminishing the force of the circulation, puts a temporary check upon the hæmorrhage; and, by giving time for the formation of a clot, and for the contraction and retraction of the divided vessel, may even put a permanent check upon the bleeding. But more commonly, especially if an arterial trunk has been laid open, the reaction after syncope is followed by a renewal of the hæmorrhage; and thus, by frequent and protracted recurrences of the bleeding, the patient is exhausted. Great loss of blood in this manner gives rise, after a time, to dropsical swellings, and to a bloated appearance of the whole body; to irregular determination of blood to particular organs; to throbbing of the temples, buzzing sounds in the ears, dark spots before the eyes; sometimes to total loss of vision, to gasping and labored breathing, to utter exhaustion of muscular strength, to repeated fainting, to muttering delirium, and to fatal coma.

Primary hæmorrhage from the capillary vessels usually ceases spontaneously, but not always; and some forms of injury give rise to an immense flow of blood from these minute vessels. I have known a slight scarification of the gums lead nearly to a fatal issue by loss of blood; and I am cognizant of one

instance in which an infant bled to death from a leech-bite. Hemorrhage from the veins, except where the flow of blood is kept up by artificial means, usually ceases spontaneously. But where, from pressure above the point at which a large vein is opened, or where the sides of the vessel are not allowed to fall together so as to close its calibre, the hemorrhage may continue to recur until the patient dies. For this reason, varicose veins, when opened, are apt to bleed profusely; and so the large veins in the axilla, or at the root of the neck. Secondary hemorrhage is not frequent either from the capillaries or the veins, for the reason that, in the progress of inflammation among these vessels, their calibre becomes blocked up with coagula or with inflammatory deposits, before their parietes give way. I have seen the veins traversing wide abscesses reduced to firm cords before yielding to the process of disorganization; and where their calibre does not become blocked up by internal coagula, the inflammation around them will cause their walls to contract until their calibre is obliterated. I have seen the lower extremity of the deep jugular vein thus contracted, by inflammation in its neighborhood, until at the narrowest point it did not appear thicker than a pack-thread. Veins, on the contrary, which, from morbid thickening and induration of their parietes, cannot contract, will continue to bleed like arteries. I have known a varicose vein on the leg, accidentally ruptured by a slight bruise, lead, in less than one hour, to death, by loss of blood.

Arterial hemorrhage is always dangerous; and when from a vessel of even moderate dimensions, will continue to recur, if left to itself, until the patient dies. Secondary hemorrhage by erosion, by sloughing, or by ulceration and disintegration is almost always arterial; although I have occasionally seen it from erosion of large veins, especially of the femoral vein, when irritated by the application of a ligature to the contiguous femoral artery. Primary hemorrhage is usually most profuse from clean cuts and stabs; less profuse from lacerated and contused wounds. Sometimes from the severest lacerated wounds there will be no hemorrhage at all. I have seen the arm, on several occasions, wrenched from the body at or near the shoulder, without giving rise to hemorrhage; and on one

occasion, the leg torn violently off at the hip-joint, without loss of blood. The lacerated femoral artery, in this instance, could be seen pulsating strongly in the midst of the wound, but giving issue not even to a drop of blood. This patient, after partial reaction, died of collapse, without bleeding. Secondary hemorrhage, on the contrary, is most frequent after contused and lacerated wounds; for in these, external sloughing and ulceration of the arteries, as well as other tissues in the neighborhood of the injury, are most frequent. An artery, whose walls have been partially divided or torn, will bleed more obstinately than one torn or cut completely across. In the one case the natural elasticity of the vessel allows the opening in it to gape; while in the other case, after complete separation the two portions of the vessel contract in their calibre, and retract or draw inward in such a manner as to wrinkle their inner surface, and thus diminish the size of the stream of blood, and give points for the attachment of clots, by which the opening, already contracted, may be permanently closed.

An artery, when injured, and when the blood is prevented from finding a free outlet, may not close, but form a sack of blood upon its side, which communicates with its inner surface, which sack is called an aneurism. This may continue, with only moderate annoyance to the patient, and without great increase, for years; or it may increase rapidly, and diffuse itself, until it suddenly gives way, after continuing for weeks, months, or years, and thus terminates fatally, either by external or internal hemorrhage.

Of wounds in the heart, sufficient will be found in the author's text. I may merely add that minute wounds through the muscular parietes of the heart may cicatrize. I once saw such a wound that had traversed the right ventricle near its base, far advanced in the process of cicatrization. The patient survived the injury about twelve days, and died suddenly while walking across his ward from the water-closet, where he had been straining violently at stool. The straining was, in this instance, the direct cause of tearing open the nascent cicatrix, and forcing out the blood from the ventricle. This case occurred several years ago, in a patient of my own, at the New York Hospital. It has, I believe, been several times alluded to in print, though

never before by myself. Wounds of the thin auricles of the heart are not apt to contract; and, as the blood issuing from these openings meets with no resistance, they lead more certainly to a fatal catastrophe than those in which the ventricles alone are injured.

3. *Reaction.* When the system rallies gradually after a moderate shock, the ensuing reaction may not transcend the limits of health, and the patient is restored to his normal condition. But when the injury is serious, and the shock severe, disordered action, local or general, is the consequence. Those parts of the body which have been too much hurt to retain their vitality become disintegrated, and are gradually removed by ulceration; or they fall into gangrene, mortify and are thrown off as sloughs. Those parts, on the other hand, which still retain sufficient organic vigor, become inflamed, and undergo the changes essential to their restoration. The constitutional phenomena following reaction, and involving mainly the vascular system, vary in duration, in type, and severity, with the varying character of the local ailments, upon which, for the most part, they immediately depend. But the constitutional phenomena manifested in the nervous system, once excited by the local ailment, are no longer wholly amenable to it, and hold no relation with it, or at least none that can be readily appreciated, either in duration or degree of severity. Again, even in regard to the constitutional disturbances in the vascular system, it is wrong to suppose that these will always subside with the subsidence of the local ailment. There are secondary diseases developed, sometimes by the general excitement of the vascular system, sometimes by the primary local disorder itself, which react on both of these, modifying or aggravating them, or becoming, in their turn, the dominating maladies.

4. *Inflammation.* The symptoms and ordinary stages of the reparative process, or what is sometimes called healthy inflammation, need not here detain us. As the result of a local injury in an individual of good general health, inflammation, when of moderate severity, tends to the reparation of the injured part, either speedily, and without effusions of pus or fibrine, by what is termed resolution, or less rapidly, and after

such effusions have been thrown out. In this latter case the restorative process is somewhat complicated, and if there has been a loss of continuity at the seat of injury, after these effusions have been thrown out, the reparative process will be effected through the successive stages of granulation, adhesion, fibrinous consolidation, and permanent closure or cicatrization. But where the inflammatory action is excessive, it may exhaust the vital energies of the injured part or the forces of the whole system, before its completion, and thus, at any of its stages, lead to fatal consequences. And even when it goes through all its stages and disappears, its result is not always the restoration of the injured organs to their primitive condition of health, with the capacity of executing their normal functions. Organic embarrassments and functional disorders, more or less permanent, may remain, taking their character from that of the organs or parts of the body which they happen to involve.

But the reparative process, at any of its stages, may, by the varying conditions of vital action, and independent of any known extrinsic agencies, be diverted from its usual course, and give rise to phenomena of various kinds, which are sometimes classed under the common name of unhealthy inflammations. Thus ordinary or healthy inflammation has no tendency to unlimited diffusion, such tendency being prevented by the fibrinous effusions which consolidate the parts surrounding the inflammation, or embraced in it, and thus localize the disordered action, as if by an insurmountable wall of circumvallation. But when, from some change in the quality of the blood, or from other causes not always appreciable, the fibrinous effusions are not thrown out, the wall of circumvallation is not established, the morbid action is extended to the surrounding structures, spreading sometimes along the integuments, assuming the form of erysipelas; sometimes among the deeper layers of the cellular tissue, giving rise to diffuse abscesses; sometimes along the inner surface of the veins, giving rise to suppurative phlebitis, and to the consequence of this, purulent cachexia; sometimes along the course of the lymphatics, giving rise to those red lines occasionally seen reaching throughout the whole length of a limb, known to surgeons under the name of

angeioleucitis, with its accompanying swellings in the lymphatic glands, adenitis, and buboes, and with its corresponding rigors, and other severe disturbances of the whole system.

There is, again, another series of morbid actions developed by a particular class of wounds, as for example, by the bites and stings of venomous or rabid animals, and sometimes by the introduction of acrid or noxious substances through ordinary wounds. These are classed under the head of Poisoned Wounds, and the local diseases induced by them are spoken of as specific inflammations.

5. *Erysipelas*. Traumatic erysipelas, or that form of the disease which is associated with local injuries, may be developed by peculiar circumstances connected directly with the wound itself; as, for example, where the morbid effusions are shut in and allowed to contaminate the surrounding tissues; or it may be developed indirectly through agencies influencing the general system, as from disarrangement of the digestive functions, arrest of the natural exhalations or secretions, impure air, or an atmosphere charged with unhealthy exhalations from other individuals. In short, any agency tending to irritate the fluids locally or generally, during the process of reparatory action, may give rise to it.

The symptoms of this form of unhealthy inflammation, need not here detain us. When superficial, erratic, and confined to the surface of the skin, the constitutional disturbance associated with it is light, varying but little from that associated with ordinary healthy inflammation. But the morbid action may involve the whole thickness of the skin, and be at the same time erratic. Here, if the disease do not progress to suppuration, though the constitutional disturbance is more serious, and actually of a typhoid character, it may still be controllable, and lead to no serious or permanent detriment. But again, beginning in the subcutaneous tissues, and extending to the skin, or beginning in the skin and extending to these tissues, it may progress to suppuration, to gangrene, to complete and wide-spread disintegration and sloughing of skin, of cellular tissue, of tendons, fasciæ, and muscles, leading to a fatal issue by the direct amount of local injury; or, poisoning

the whole system, it may give rise to a low grade of typhus, under which the patient sinks exhausted.

Again, where the general type of the disease is not so grave, it may still lead to serious or fatal consequences. Thus, by extending along the mucous surface of the fauces, it may lead to suffocation by œdema of the glottis, or to fatal inanition by interfering with the organs of deglutition. Extending to the orbit, it may lead to loss of vision; and creeping thence, or from the scalp, inward to the brain and the envelopes of the brain, it may lead to violent mania, or to fatal coma. From the surface of the chest it may extend inward to the pleura, or pericardium, leading to pleuritis, to inflammation of the lungs, or to inflammation of the lining membrane of the heart, effects which I have myself witnessed from it, and either of which may terminate in the death of the patient. So, from the surface of the abdomen, it may extend to the peritoneal cavity, and eventuate, as I have also known it to do, in fatal inflammation on the bowels. Again, in the neighborhood of the joints, it may extend to these, leading either to permanent loss of the joint, by ankylosis or rigidity, to the loss of limb by amputation, or, where this is not performed, to protracted suppuration, and to irritative and hectic fevers, which sooner or later terminate in death.

In its leading features, traumatic erysipelas does not vary essentially from that form of the disease which originates spontaneously. But this latter is not to be confounded with the host of chronic cutaneous eruptions which are popularly but erroneously called erysipelas. Nor is it true that traumatic erysipelas always develops itself in the immediate vicinity of the injury, and thence spreads to other parts. Like the spontaneous variety, it may first show itself on any part of the body; though, as a usual rule, it first attacks parts already diseased; and most commonly, the parts at the seat of the injury are the first to suffer from it.

6. *Angioloecitis, or inflammation of the absorbent vessels.* This modification of unhealthy inflammation may follow wounds or injuries in any part. It is most frequent after injuries of the head and face, or those low down on either of the upper or lower extremities. From these points, lines of inflammation,

as if produced by the stroke of a whip, extend in the course of the absorbent vessels, down the sides of the neck, or along the arm, or up along the leg and thigh, to the trunk; and in connection with these red lines, will be observed hard and painful swellings, involving the lymphatic glands; in the neck; at the lower part of the arm, near the elbow; at the axilla, or at the groin; which, when of moderate size, hard, and movable, are characterized as kernels or adenitic tumors; and when of greater dimensions, firmly fixed, and progressing to suppuration, are, at some points, as at the groin and axilla, spoken of as buboes. The constitutional disturbance attending this disease is, at first, that of high inflammatory fever, but of temporary duration, ushered in by chills and rigors, and subsiding in profuse perspiration. In poisoned wounds, dissection wounds, and after the stings and bites of some venomous animals, this form of inflammation ushers in specific constitutional disturbances, which will be more or less severe according to the nature of the poison introduced, and the power of the constitution to withstand it. Angeioleucitis is rarely of itself fatal; but by giving rise, which it sometimes does, to erysipelas, or to suppurative phlebitis and purulent cachexia, it may be indirectly the cause of death.

7. *Suppurative phlebitis and purulent cachexia.* The veins, under healthy reparative inflammation, as already stated, become closed either by the coagulation of the blood within them, or by effusions of coagulable lymph. But under unhealthy inflammation, the plastic lymph is not effused; and the inflammatory action once established on the inner surface of these vessels, spreads indefinitely, and proceeds to suppuration. Their morbid effusions now mingle with the blood, or contaminate that fluid by imbibition, giving rise to a febrile and depraved condition of the whole system, with a tendency to form abscesses and sudden collections of pus in almost every part of the body. The subcutaneous cellular tissue, the joints, the muscles, the brain, the lungs, the walls of the heart, the liver, spleen, kidneys, uterus—in a word, every organ of the body, and particularly the lungs and the heart—suffer from these purulent collections. It is not uncommon to find both lungs completely studded with abscesses, varying from the size of a

pea to that of a horse-chestnut, or even larger, which form within a few days, and rapidly lead to a fatal result. It is rare to see a patient recover from purulent cachexia; and when the secondary abscesses occupy the lungs, the liver, or any other vital organ, recovery may be considered next to impossible. The slightest injury to veins already in a state of irritation, will sometimes give rise to this deplorable disorder. I have seen it after applying a ligature to an inflamed pile, and on several occasions after tying or dividing varicose veins, and several times after the operation of tying the femoral artery where the femoral vein happened to be abraded. It is a frequent result of operations upon the bones; and it is, perhaps, the most frequent cause of death in that form of disease following parturition, and which is called child-bed fever, or puerperal fever. It is not unfrequently associated with diffuse phlegmonous erysipelas and angeioleucitis, and it occasionally follows profuse suppuration from any cause.

The febrile symptoms developed by it, are those of high vascular excitement, coming on in paroxysms daily, or two or three times a day, after irregular intervals; this vascular excitement being intermingled with rigors and profuse sweat, and the other associated symptoms varying with the organ or locality within which the purulent deposits happen to form. If on the lungs, these may give rise to cough and other pneumonic embarrassment, not always so alarming, however, as the gravity of the lesions would seem to indicate. If on the liver, they give rise to jaundice; if on the kidney, to disturbance of the urinary secretion; and when this secretion is suppressed, to convulsions, mania, coma, and other serious symptoms, the result of uremic poisoning; and if in the joints, giving rise to symptoms easily mistaken for those of acute rheumatism. Purulent cachexia, otherwise called purulent infection, is always rather rapid in its progress when once developed, but it is not always developed in the early stages of the local disease which gives rise to it.

8. *Fever.* Traumatic fever, or that which results from local injuries, may assume almost any type—the open inflammatory, the typhoid, the ephemerai, the irritative, the suppurative, the hectic, the continued, the irregularly intermittent or paroxys-

mal. In association with reparative inflammation, it is usually of the continued type, though even here, at times, paroxysmal. In connection with unhealthy inflammation it is more apt to be paroxysmal and irregular, with tendency to rapid exhaustion of the vital forces. The severity, as well as the type and duration of the fever, is somewhat depending on that of the inflammatory action with which it is associated. Unhealthy inflammation is sometimes the precursor, sometimes the sequence of the constitutional disturbance; but the fever associated with healthy inflammation, is almost always determined by the local ailment, and unless secondary complications supervene, it terminates with or before the subsidence of this.

9. *Secondary local disorders.* When the constitutional reaction is severe or protracted, it is apt to develop ailments in parts of the body more or less remote from the primary injury, and independent of those which result from contamination of the blood, as in purulent cachexia. Among these secondary local diseases, the most frequent are those of the lungs and organs of respiration generally; but they are also apt to affect the mucous surfaces, the stomach, the liver, and other organs in the abdominal and pelvic cavities; the brain and its envelopes; the joints and organs of locomotion, or several of these parts simultaneously. It is rare for inflammatory and febrile reaction, resulting from local injury, to terminate fatally, without giving rise to one or more of these secondary maladies. And after the local disturbance giving rise to the fever has subsided, the secondary malady may continue to disturb the whole system, and either continue the febrile excitement or kindle it up anew. Any one of these secondary ailments, again, may be of sufficient gravity to prove fatal.

10. *Disorders of the nervous system.* The ailments to which allusion has hitherto been made in connection with inflammation, are mostly such as spend themselves upon the vascular system. There is another class originating in the same manner, but affecting mainly the nervous system. Among the latter are spasmodic diseases of various kinds: convulsions and paralysis, local and general; neuralgia, delirium tremens, traumatic delirium, and tetanus. It is not my purpose, nor

is it here necessary, to enter into an account of each of these. I may remark, however, that traumatic delirium is not to be confounded, on the one hand with the ordinary delirium of fever, nor, on the other, with delirium tremens. The latter is seen only in those who are habituated to alcoholic drinks. It may occur independent of any local injury, and of itself is not usually fatal. But traumatic delirium may exist without fever. It is seen in persons of strictly temperate habits; it is not attended with the violent mania, nor the muscular agitation of delirium tremens; it occurs only after injuries of the severest grade, and, when seen, is a pretty sure indication that death is near at hand, even while the other symptoms would seem to give no such serious warning.

Tetanus, though looked upon as the most alarming of all the disorders of the nervous system that are consequent upon wounds, is not uniformly fatal. It has been my fortune to treat many cases of it successfully. In warm climates, and in some localities elsewhere, it is said to be occasionally developed spontaneously. But after an extensive acquaintance with tetanus in hospital and private practice for more than twenty-five years, I can venture here to say, that I never yet have seen an instance of it which was not directly traceable to local injury of some sort, as a burn, a contusion, a scratch, or an irritable local sore. The only instance in which I ever saw it result from other than a mechanical or chemical injury, was in the case of a child a few months old, suffering from congenital syphilis, and from ulcerations about the skin depending upon that affection. Tetanus is strictly a symptomatic disease. It holds, however, no relation in severity with the local disease giving rise to it, and it may terminate fatally, by suffocation, by arresting the heart's action, or by gradually exhausting the vital force, without leaving any visible traces upon the body after death. The patient surviving an attack of it for a week has a fair chance of recovery. It rarely terminates fatally after running a course of three weeks. It may be developed at the very instant a local injury is inflicted, or at any period afterwards, up to that of perfect cicatrization of the wound.—J. W.]

2. *Of the nature and prognostics of wounds of particular parts.*

I shall endeavor to make this section as concise as possible, as it is only intended to be a general guide to the medical examiner. The opinions deducible from it are subject to many qualifications, which the peculiarities of every case alone indicate, and they are evidently not to be quoted as universally applicable.

We shall notice *wounds of the head* in the first place; and here a preliminary remark cannot too soon be made or enforced, viz., that in no other part is the prognostic more uncertain, nor is there one in which the physician has more occasion for suspending his judgment. The general prognostic of wounds of the head depends on the nature of the injured parts, the age and condition of the patient, the nature of the instrument with which the wound has been inflicted, the force or violence used, the manner in which it was applied, and the effects that followed.

A wound of the integuments of the cranium, if inflicted with a cutting instrument, such as a knife or razor, may be deemed a simple wound, which will heal within the space of a few days.* But if the instrument, although a cutting one, is of great weight, and has been projected by a strong arm, we

* Wounds of the integuments of the skull are extremely capricious in their results: the slightest, especially punctured wounds, often communicating inflammation to the bone and membranes of the brain, while wounds much more extensive heal readily. Of the latter, a striking example came under my own immediate observation: A soldier got drunk on the line of march, and was put into a baggage-wagon, out of which he fell, his head coming right in the track of the wheel, which passed obliquely over it, stripping the whole of the integuments off one side of it, and leaving the bone completely bare. The integuments were replaced and secured by stitches, and the whole kept *in situ* by means of bandages. He travelled for four days on the wagon, when he was put into the hospital, and in less than a fortnight was enabled to resume his duty.—DUNLOP.

[A more remarkable case of this sort occurred in my practice some years ago. A woman, over seventy years old, fell upon a stone step, and the scalp was cut through on the top of the head, and the bone denuded for the space of two or three inches, yet the wound healed chiefly by the first intention.—C. R. G.]

should reserve our prognostic on account of the subsequent affection of the brain, which may justly be dreaded. If a sharp-pointed instrument has been used, and it has penetrated as far as the bone, the inflammation and pain that follow are more severe than from incised wounds. When a contused wound has been inflicted, as by a stick or stone, the prognostic will depend much on the immediate symptoms, and it will be dangerous in proportion to the dizziness, nausea, insensibility, etc., that are experienced for a short time thereafter.* A

* I have found in the collection of pamphlets made by the late Sir James Mackintosh, and which (amounting to upwards of one hundred volumes) is now in the library of the Albany Institute, one with the following title: "An Appeal to the Public, touching the death of Mr. George Clarke, who received a blow at Brentford on the 8th of December, of which he languished and died on the 14th. By John Foot, surgeon; London, 1769."

Mr. Clarke received a blow on the head with a bludgeon, during the election riots, from Edward McQuirk. The wound bled profusely. On his way home he felt faint, and took some brandy. He went to bed, and his symptoms gradually became aggravated. He was bled on the 10th, but without any improvement. On the 12th an apothecary was called in, who found him in a violent fever, with delirium. He applied remedies, and on the next day Mr. Bromfield, the surgeon, was sent for, but does not appear to have prescribed. He died in the night.

Mr. Foot was called on to examine the body before the coroner's jury. He desired the aid of Mr. Bromfield, who refused to come, "because he apprehended it might be an Old Baily business." There was a contused wound on the head by the side of the sagittal suture, upon the right parietal bone; the scalp was elevated for a considerable space round the wound, and the pericranium was much inflamed and separated from the skull. On removing the upper part of the skull, the dura mater, directly under the part where the injury was inflicted, was found greatly inflamed and detached from the bone. Between it and the pia mater was a quantity of coagulated blood. The pia mater was inflamed, and some of its vessels ruptured. There was no fracture.

From these appearances and the history of the case, Mr. Foot gave it as his opinion that the blow had been the cause of death, and he repeated this on the trial, where it also appeared that Clarke was a healthy young man, and of temperate habits. McQuirk was found guilty.

Shortly after his conviction, the above testimony was referred to the court of examiners of the Surgeon's Company, on the ground that neither Mr. Bromfield nor the apothecary had been examined on the trial, and that Mr. Foot had never seen the deceased until after his death. The court gave it as their opinion, but without assigning reasons, that Clarke *did not die* in consequence of the blow; and McQuirk received a full pardon.

Of the court of examiners above mentioned, Percival Pott was a member, and Mr. Foot, with perfect fairness, points out his inconsistency, by refer-

superficial contusion, accompanied with laceration and none of the above symptoms, may generally be deemed a slight wound.* But a contusion, however slight, on the region of the temporal muscles, is scarcely ever exempt from danger, on account of the intimate connection of this part of the brain, by means of its nerves, blood-vessels, and membranes.†

Wounds of the pericranium, in good constitutions and well treated, are not dangerous; but in bad ones they are often serious, and are succeeded by an erysipelatous inflammation, which is readily extended to the brain. A complete division of the pericranium is much less to be dreaded than a wound from a sharp-pointed instrument. In venereal patients, caries of the bone is a frequent consequence of such injuries.‡

ring to his *Memoir on the nature and consequences of those injuries to which the head is liable from external violence*. The only possible ground for the opinion of the court of surgeons was, that the injury had been neglected. It is evidently a case greatly influenced by strong party considerations.

(It is this case which is noticed with so much severity by Junius, in Letter Eight, addressed to the Duke of Grafton.)

* "We may, by the contusion being *superficial* or *deep-seated*, infer, to a certain extent, how the injury has been inflicted. Superficial contusions, we may infer, have been inflicted by the smart stroke of a comparatively light body, while the more deep-seated contusions must have been occasioned by some more ponderous weapon." (Watson on Homicide, p. 254.) Under this last heavy blows with the fist are to be included.

† [Or rather because the skull beneath this point is thin and easily broken, and the large artery for nourishing the membranes of the brain is here liable to be ruptured.—J. W.]

‡ Was there ever a case known in which the bones of a venereal patient ran into caries, where no mercury had been exhibited? (DENBOR.) Probably not; but my object was to indicate the increased irritability and consequent danger in persons so situated being wounded. Sir A. Cooper states fatal results from operations on persons who had just gone through a mercurial course. (Lectures, vol. i. p. 30.) [Caries of the bones of the skull is not unfrequent in persons who have long suffered from the venereal disease. But caries of venereal origin is the direct result of nodes; and, so far as an extensive experience in the treatment of wounds, as well as of the venereal disease, will enable me to speak, mechanical injuries are not more likely to lead to caries in syphilitic patients than in other persons. I may here add, that neither a good constitution nor proper treatment will always avert the occurrence of erysipelas after wounds of the pericranium. But this accident is much more likely to occur where the wounds are closely drawn together by stitches and other tight dressings, than where they are allowed to gape a little, and where the effused fluids can find easy egress through the cut.—J. W.]

Fracture of the bones of the cranium may take place without any correspondent injury of the integuments, and the symptoms in such cases are extremely equivocal and deceitful. As the form of the head is an arch, we should recollect that a blow does not necessarily fracture the part on which it falls, but often extends to other parts.* Our deductions must, however, be drawn from the circumstances that immediately followed the infliction of the wound, from those that afterwards supervene, and from a consideration of the causes producing them. Among the first are vertigo, loss of sense and motion, vomiting, and bleeding from the nose and ears. Among the latter may be inflammation, coma, convulsions, and paralysis.† Fracture may, however, occur without any of these being present: and again, they may all be present without any fracture, and result from concussions of the brain.‡ It should be remem-

* On a trial before the court of justiciary, in Scotland, in 1812, it was proved that the murder was committed by repeated blows on the top of the head, yet on dissection, it appeared that death followed from extravasation of blood from four fractures, all of which were at the base of the skull. (Dunlop's MS. Lectures.)

This indeed frequently occurs. A fracture of the skull, and particularly of the base, may not be situated at the part where the violence has been inflicted.

Mr. Watson quotes the assertion of Orfila, that the danger is greater when the violence has been applied from above downward than either when from before, backward, or from one side to the other. (Watson on Homicide, p. 86.)

† "Upon the authority of Sir A. Cooper and others, it may be asserted that inflammation of the brain after injuries does not, in general, supervene for about a week after the accident, nor is the patient to be considered safe or out of danger till two or three weeks afterwards." (Watson on Homicide, p. 62.)

The following is said to be an aphorism of Dupuytren: "Hemorrhage from the ear, accompanied with coma, almost invariably indicates a fracture of the base of the skull." (Medico-Chirurg. Review, vol. xxxviii. p. 515.)

‡ In the London Medical Repository, vol. xxiii. p. 346, is a case of a man wounded with a pickaxe in the left hemisphere of the brain, with laceration of the left ventricle, who walked a mile and a half to the hospital. He died, however, in two days.

Mr. Wallace, of Dublin, also relates a case of most severe injury to the skull, brain, and spinous processes of the vertebral column, owing to a fall from a scaffold. Yet the patient, soon after the accident, walked up the stairs of the hospital. Death ensued in three days. (Lancet, N. S., vol. xviii. p. 162.) Similar cases are recorded in British Annals of Medicine, vol. ii. p. 93; Edinburgh Monthly Journal Medical Science, vol. i. p. 230.

bered that fracture, accompanied with depression of the bone, is usually more dangerous than when no depression is present.

Concussion of the brain is always dangerous, as are also all wounds of the brain and its membranes.* On these it is not

* "It seldom happens that concussion destroys, but when it does, nothing is found upon the examination which will account for the symptoms. It is, therefore, an alteration of function, but not a disorganization. But where the concussion is very violent, it is attended with lesion of the brain." (Sir A. Cooper's Lectures, vol. i. p. 119.)

"In a medico-legal point of view, it is very important to observe that concussion of the brain may prove fatal, without either fracture of the skull, effusion of blood within the cranium, or any other change being observed on dissection." (Watson on Homicide, p. 35.)

A fact stated in these quotations cannot be too distinctly impressed on the mind of the medical examiner. Indeed, it may be asserted, that "*violence may prove fatal to life, without leaving any traces of its effects on the organ primarily affected, (the brain,) and without being indicated by any considerable external marks.*" The following case clearly illustrates this: On the 20th of December, 1833, three men, after a drunken quarrel at an inn, attacked a person who had interfered, and who was on the way home with them. They beat him with sticks on the head, body, and legs, and subsequently dragged him along the ground, and then flogged him with switches. He ran away from them after having been thus maltreated for at least half an hour. Shortly after he was seen walking along the high road, his dress and person covered with blood, and with a tottering and feeble gait. He related his story, and assistance being afforded, he was carried in a cart to the village whence he had come. Medical aid was called in, but he was then insensible, and in a very short time he expired. On examination, contusions were found on every part of his body, but the viscera of the chest and abdomen were perfectly healthy. The skin in the region of the occiput was much ecchymosed and swollen, and beneath was found a considerable extravasation of blood. On the vertex there was an oblique wound about an inch and a half long, which penetrated to the bone. But on removing the scalp, the bones of the cranium were found uninjured. The vessels of the dura and pia mater were much congested, but the brain itself presented no unhealthy appearance.

Now here was no manifest cause of death, although the contusions had evidently been severe. The symptoms of concussion, in its ordinary surgical sense, had not been present; neither those of compression. The examiners attributed death to apoplexy, indicated by the congested state of the vessels, and brought on, in their opinion, partly by external violence, and partly by the pain, state of excitement, and fear, under which the deceased had been laboring. In the absence of its ordinary symptoms and its pathological proofs, it would certainly seem correct to assign as a cause of death "the shock produced on the system through the brain and nerves by the continued and repeated violence." For this case, and the comments on it, which I

necessary to enlarge at this time. It is, however, proper to remark, that the prognostic of wounds of the head is, for the most part, that they are dangerous, and require the strictest attention. Thus effusion of blood within the cranium may occur very slowly or very rapidly. In the former case its symptoms will of course be late in their developments. In numerous instances, indeed, injurious and even fatal consequences have been produced long after the infliction of the injury, and that, too, where the immediate symptoms have given little or no reason for such a termination.*

have adopted, I am indebted to the British and Foreign Medical Review, vol. iii. p. 248, which quotes its incidents from Henke's Zeitschrift. It is judiciously added that, in this instance, the common inquiry at coroner's inquests, and on trials for death caused by violence, could not have been affirmatively answered. Was there a *particular wound that was the cause of death*? "The truth is, a multiplicity of injuries, long continued, although productive of only slight marks externally and internally, are as capable of destroying life as if an individual were at once wounded in a vital organ."

This subject is well considered in an essay by Dr. Bayard, "*De l'Appreciation medico-legale des effets de la commotion cérébrale.*" (Annales d'Hygiène, vol. xxvi. p. 197.)

* The succeeding case will illustrate the difficulties that sometimes envelop the cause of death: "A woman received a blow on the head from a laundress' iron, but no fracture or injury of the cranium was discoverable, though it was thereby laid bare. She was (by the advice of the celebrated Cheselden) trepanned, and still no mark of injury about the cranium was discovered. She went abroad, and followed her ordinary business for a fortnight afterwards; but at the end of twenty days from receiving the injury, died. On opening the head, they found a very large imposthume in the middle of the brain. This occasioned some perplexity about the real cause of death. The surgeon who had managed the case was rather inclined to attribute the death to the blow, but would by no means deny that it might have proceeded from some inward cause. The deceased had been subject to frequent and severe headaches before the accident occurred. Mr. Cheselden, being examined on the trial, declared that he could not conceive how a blow should be the cause of death where there was no extravasation, and the person could go about for a fortnight afterwards. His allowing, however, that *similar appearances were sometimes found in the brain of persons subject to headaches, was of more importance to the prisoner.*" (Smith, p. 246.) The following is one among a thousand instances where death has been induced at *distant periods* from the infliction of violence on the head: The patient died several weeks after receiving the injury, and on dissection, Mr. Charles Bell discovered a fracture at the base of the skull; and the foramen magnum having been thereby roughened, a sudden turn of the head had forced a speculum of bone into the spinal marrow. (Smith, p. 252.) The principal and im-

The opinion of the medical examiner must, therefore, be founded, not only on general principles, but on the symptoms that are present; and when called into a court of justice, he should explain how uncertain the recovery from such injuries always is, and on the other hand, that persons have survived the most terrible accidents. The presence or absence of fever, or delirium, or coma, and the healthy or livid appearance of the wound, all aid in determining on the danger. The following aphorisms of the illustrious Vicq. d'Azyr are quoted by French surgeons as comprising the experience of the art on these points, and they are evidently deserving of remembrance: 1. That the largest wounds of the head are not always the most dangerous. 2. That it is possible to lose a considerable quantity of the brain without death ensuing. 3. That the slightest injuries are often succeeded by fatal consequences, and that hence they should in no case be neglected. 4. That a contusion of the bone alone may gradually extend itself, so as to affect the brain.*

portant inference to be drawn from such cases is, "the *impropriety* of maintaining the general proposition, that the death of persons recovering from the *immediate* symptoms of violence, should never be ascribed to that violence."

Mr. Howship relates a case where a slight blow on the head, at the age of fifteen, produced death *forty years* afterwards. Pain was frequently present during life, and latterly somnolency and impaired vision. On dissection, the bone at the place injured was seen transparent, and almost wholly absorbed, and the portion of brain under it was indurated and scirrhus. (New England Journal, vol. ix. p. 403.) On the other hand, in the Medico-Chirurgical Review, vol. v. p. 273, a case is quoted from Lallemand on the Brain, of a boy who had received blows on the head: symptoms of low fever followed, and he died on the twentieth day. On dissection, purulent effusion was found, and marks of inflammation and adhesion in the arachnoid opposite the right petrous portion of the temporal bone. The parents, on being questioned, confessed that he had long complained of pain in the head and the right ear. The mastoid bone was now examined, and its cells found full of pus. The physicians consequently testified that disease had existed anterior, and that the blows could only have accelerated the fatal termination.

* [And he might well have added, that the diseased appearances discoverable within the brain, or among its membranes, do not always correspond to, and may be very remote from, the seat of the external injury.—J. W.]

Foderé, vol. iii. p. 312. I must be permitted, in this place, to caution the young surgeon not to use the trepan without a due regard to the rules laid down in surgical works. He may otherwise be injured in his reputation before a court of justice, and his practice may be condemned by those who

It must be understood that many cases have occurred in which a blow on the head, by the fist alone, has proved fatal, and particularly so, if the person be struck behind the ear. Concussion is the consequence, followed frequently with laceration of the blood-vessels. And a question sometimes arises, whether death has originated from the blow or a consequent fall. In legal construction, the culpability is, I believe, considered the same, whether it originate from either. But still there may be instances in which it is important to discriminate. The circumstances, according to Mr. Watson, which render it probable that the blow, and not the fall, is the cause, are—that such effects are very rarely, if ever, observed from similar falls, without a violent blow at the same time; that in many instances the fall has been on soft ground; and lastly, that the internal effusion of blood has generally been found either at the place corresponding to the external mark of the blow, or on the side opposite to the external mark, a circumstance which connects the effusion with the blow.*

“Wounds of the dura mater alone are more injurious than when both dura and pia mater are wounded. In this last the brain immediately projects and fills up the wound. Inflammation of the dura mater spreads over the cavity down the spine, (by continuity of surface.) I have seen many instances of recovery when both were wounded, few where the dura mater alone has been wounded.”†

are better informed. “There can be only one genuine reason for trepanning, viz., to remove such pressure from the surface of the brain as gives rise to *existing* bad symptoms.” (Samuel Cooper.) [This rule is rather too stringent, and is often disregarded.—J. W.]

A case where this was neglected, and thus all chance of recovery taken away, is related in the British and Foreign Med. Review, vol. vii. p. 259, from Henke's Journal.

* Watson on Homicide, p. 43. [The appearances within the skull resulting from an apoplectic effusion, differ from those which follow an injury. In the former, the parts of the brain surrounding the effused blood are softened, or otherwise diseased. In the other, the surrounding tissue may be quite healthy.—J. W.]

† Sir A. Cooper's Lectures, vol. i. p. 155. “If effusion of blood be found between the dura mater and the skull, and if a bruise on the scalp correspond to the part, we may conclude that it has been caused by the blow; but if blood is found between the dura mater and the brain, though we should dis-

Mr. Brodie, in his remarks on injuries of the brain, observes that he has not been able to discover, among all the works which he has consulted, an instance of recovery from a wound of the posterior lobes of the cerebrum,* of the cerebellum, or of the medulla oblongata.†

I conclude this division of my subject with calling the attention of the reader to the following remark: "In criminal trials for the infliction of injuries upon the head, in which the injured individual is able to be a witness, it is obvious, from the disordered state of the intellectual faculties, and particularly of the memory, arising from concussions, that his evidence should be taken with extreme caution in regard to circumstances which happen at the time of the injury, and indeed it should only be received in so far as it is corroborated by other testimony."‡

cover the marks of blows, or even fracture of the skull, still the question may be: might not the patient have been attacked with apoplexy during the struggle?" (Shaw's Manual of Anatomy.)

A man in Paris, quarreling with another, struck him on the forehead with an iron punch, so violently that he fell backward on the ground. The wound was irregular and long, from the glancing of the weapon, extending toward the left temple. Lisfranc attended the injured person at the Hospital de la Pitié, to which he had been taken. On his trial, the accused maintained that the injury was owing to the fall. There was, however, direct testimony that the wounded person had fallen on his back, and Lisfranc denied that it could have thus happened, since all indications of contusion were wanting.

* [With regard to the posterior lobes of the cerebrum, Mr. Brodie's remark is too general; at least fractures of the skull immediately over these lobes frequently do well.—J. W.]

† Medico-Chirurgical Transactions, vol. xiv. p. 421.

‡ Watson, in Edinburgh Medical and Surgical Journal, vol. iii. p. 109.

Remarkable injury to the head, compatible with life, by Dr. O'Callaghan, Surgeon of the 11th Hussars. Read before the Surgical Society of Ireland, January, 1845.

Lieut. Fritz was wounded by the bursting of a fowling-piece, in the Island of Ceylon, on the 23d of January, 1828. He was knocked down by the blow, but immediately rose without assistance, and walked to a neighboring cottage, where the wound continued to bleed for several hours, and produced a state of faintness approaching to delirium. In the evening he was conveyed to Fort M'Donald, a distance of four miles, in a palanquin; on his way and after his arrival, the bleeding continued at intervals, but less copiously. "Bloody serum now flows from the wound, which is of a circular form, about one inch in diameter, and situated above the nasal process of the frontal

Wounds of the face are more or less dangerous, according to the part injured; but in considering these, it is also neces-

bone, the outer plate of which, corresponding to the external wound, is destroyed. The surrounding integuments, particularly over the right eye, were much swollen, and painful when touched; complaints of constant pain shooting through the forehead, and restlessness, which effectually prevents sleep; mental faculties unimpaired."

It is not necessary in this place, although interesting as a case in surgery, to continue the details. It is sufficient to state that the wound healed, and Lieut. Fritz returned to his duty, and was subsequently promoted.

Toward the end of the year 1828, a metallic body began to protrude through the palate into the mouth, and continued gradually but steadily to advance. The sanious discharge accompanying it was extremely offensive. In May, 1835, it had protruded so far that an attempt was made to file it off, but the pain was unendurable, and the attempt was relinquished. Lieut. Fritz was intemperate, and he died of an acute attack, in March, 1836.

On examining his head, the whole of a large iron breech of a gun, with the screw that attached it to the stock, was found lodged in the forehead. The anterior part of the right hemisphere of the brain rested upon the flat part of the breech, which received the charge, separated from the iron surface only by a false membrane. The weight of this mass of iron, which remained comparatively quiet for so many years in this extraordinary situation, was near three ounces, and its length two and three-quarter inches.

In the discussion that followed the reading of this case, Sir. P. Crampton said it was a remarkable coincidence, that at the Richmond Hospital, a case had occurred exactly similar, in which the breech of a gun had lodged in very nearly the same place; the wound, in this instance, had proved fatal, the breech having passed through the orbital plate of the frontal bone, and the man survived only forty-eight hours. "At the same time, it by no means followed that the breech did not penetrate the brain in Dr. O'Callaghan's case, for no two of these accidents are observed to run a similar course." (London Med. Gazette.)

Sensibility and power of locomotion after severe injuries.—A female was brought into the Westminster Hospital in a state of senseless intoxication. The effusion of cold water caused a partial restoration of sensibility. She was removed by the police, but brought back the next morning on a stretcher, in a state of insensibility, and suffering from uninterrupted convulsions. She continued comatose, with the recurrence of convulsions, until 4 A. M. of the twenty-sixth, (two days after she had been first brought,) when she died. On dissection, there were found extensive fracture and great effusion of blood at the base of the brain, etc.

Dr. Basham observed that it was evident that the injury must have been sustained while the woman was in the custody of the police, and *after* she had left the hospital on the preceding night, for it was quite impossible, with such a fracture and such an effusion of blood at the base of the brain, that she could have been aroused to consciousness by the mere effusion of cold water.

Mr. Brittain, in order to counteract the bearing of this remark, relates the

sary to take into account the deformity and irregular cicatrices that follow them. The latter circumstances have been noticed

following: While house-surgeon in the Chester General Infirmary, he admitted Thomas Duke on the morning of July 6, 1837. He was accompanied by some friends, *walked between two of them up stairs*, staggering occasionally as if intoxicated. The day before, while attending to some horses, he was kicked and knocked down by one of them, his head striking against the wall. He got up without assistance, and sat upon a bucket, when he became very sick, and vomited the contents of the stomach, which were strongly impregnated with ale and spirits. Two medical men who were passing at the time, looked at him, and observing no wound or bruise, thought he was intoxicated, and were strengthened in that belief by his fellow-workmen, who stated that he had drunk very freely during the day. He was ordered to bed, and had some warm gruel; he vomited several times, and then fell asleep.

In the morning, the man appearing very drowsy, answering questions only when put to him in a loud and sharp voice, and complaining of headache, his master ordered him to be sent home, thinking he was laboring under the effects of drink. His friends brought him to the hospital. On examining his head, Mr. Brittain could detect no wound or injury externally; he answered questions when put to him, but immediately relapsed into a half comatose state. He stood up with very little help during the examination. He was placed in bed, his head was shaved, and evaporating lotions were applied; some aperient was also given, but he became more and more insensible for three days, when he died. On opening the head, nearly the whole of the upper surface of the brain was covered with coagulum, almost a third of an inch thick. The base of the skull was filled with coagulum, and there were two or three fractures crossing each other, extending entirely across the base. *This man walked nearly a quarter of a mile after the receipt of the injury.* (Lancet, October 14, 1843.)

Whether a blow on the head, producing fracture of the skull, ever causes immediate death.—Dr. Lente, in a communication on the Statistics of Fracture of the Cranium at the New York Hospital, (New York Journal of Medicine,) after analyzing 117 cases, of which 21 recovered and 96 died, remarks: "In no case did death follow the receipt of the injury, until after the lapse of some hours, even in the most desperate cases; nor does it appear to be possible for an ordinary blow on the head, producing fracture of the skull, to cause immediate death. In a recent criminal trial of great interest, it will be recollected that at one stage of the proceedings it was much discussed whether a blow upon the head with an ordinary weapon, capable of inflicting death, could produce this result instantaneously. Many eminent surgeons were examined, and the general impression was that the thing was exceedingly improbable, if not impossible, and the question was thus decided." (See this Journal for April, 1852, p. 579.)

Professor F. H. Hamilton, of Buffalo, in his table of Fractures of the Cranium, the cases amounting to 33, of which 21 recovered, and 12 died, according to the reporter, arrives at a similar result. (Buffalo Medical Journal, September, 1852.)

in the jurisprudence of England and our own country, as we shall state in the succeeding section.

Superficial wounds of the face are easily healed; but when deep, and attended with much loss of substance or denuding of the bones, they are tedious, and leave considerable deformity. Wounds of the forehead, in which the frontal muscles are divided transversely, or of the eyebrows, cause the upper eyelid to fall down, and may produce a lasting debility of the parts. Wounds of the eyes, when of considerable ex-

Doubtful case of concussion of the brain from external injury. (British American Journal of Medical and Physical Science, No. 1.)—The following is one among a thousand instances of uncertainty as to the effects of injuries of the head:—

While playing, on the 17th of December, 1841, P. C., aged twenty-one years, received what was described as a very slight blow on the left side of his head, from the open hand of one of his companions, which staggered him for a moment, but he was soon able to walk home to his house, a distance of one hundred and fifty yards. Dr. David saw him five hours after the accident; he was then seated in a chair, but appeared quite restless, although he could answer coherently. His pulse was full, but not quick, and no trace of external injury could be discovered. As he had been constipated, a cathartic was ordered, with cold applications to his head. He was seen again the next day, and was found walking about, and apparently quite well, and did not complain of any pain. The medicines prescribed had acted powerfully. In the night, Dr. David was again suddenly called to him; he was insensible, incoherent in his language, the pupils were dilated and unaffected by light, and his hands extended, endeavoring to get hold of imaginary objects before him. There was also a shivering, which lasted about an hour, after which he became sensible, and complained only of intense pain over both eyebrows. He was bled to syncope, and ordered repeated doses of calomel with castor oil, under which treatment he became much better, till the morning of the twenty-first, when he suddenly became comatose, and died within eight hours.

On dissection, fourteen hours after death, no fracture of the skull, nor engorgement of the cerebral vessels, nor any effusion under the membranes could be found; but on cutting into the substance of the brain, and laying open the ventricles, they were found distended with at least six ounces of limpid fluid, and with the exception of the septum lucidum, which was soft and easily torn, there was not the slightest appearance of inflammation to be found in the ventricles, or, indeed, any other part of the brain, which was firm and perfectly healthy.

"I assured the friends," says Dr. David, "that the morbid appearances were not the result of the blow the man had received three or four days before his death, but the result of some latent disease which had been going on for months before he received the injury." But had there been no dissection, the consequences would doubtless have been attributed to the blow.

tent, must always be deemed dangerous from the nature of that organ, and from the intimate connection between it and the brain. A wound with a sharp-pointed instrument has been known to pass through the orbit, and prove fatal.* Wounds

* "A man has been working in a hay-field; he has slipped and fallen; the prong of a fork has entered his eye; he has got up, drawn it out, thrown it from him, and instantly fallen dead, apparently without any cause. A speck of blood has been observed on the eye, it has been wiped away; an aperture has been observed, and upon examining the part the fork has been found to have penetrated into the brain." (Abernethy's Lectures, Lancet, vol. xii, p. 3.)

Macklin, the comedian, was tried for murdering another actor, by plunging at his eye with a piece of a pine stick, which entered the brain through the orbit. He was acquitted, as no *malus animus* could be proved.

In the Edinburgh Observer of the 27th of January, 1833, I find the following paragraph: "Ten days ago, James Bradshaw, hatter, in Greenock, having been engaged in a scuffle, received a wound on the head. He remained, slightly complaining, until the 21st. On dissection, he was found to have been killed by an injury on the eye, which had forced in the bone immediately behind the eye (the superior orbital plate, I presume) on the brain."

Baron Hume, in his work on Criminal Law, p. 256, mentions the case of a man of the name of Richard Carse, who was tried for murder, which he perpetrated by beating another man about the head with a *quaigh* or wooden dish, a splinter of which detached itself and entered the brain through the eye, when it snapped off short, and caused his death in a few days. The splinter was taken out of the eye after death.

These are cases where injury of the eye has caused death. In opposition to them, I shall relate some where the eye has received injuries as severe as those, to all external appearances, but which the patient has survived.

A case is related by Gooch, where a man had his eye blown out by the bursting of a gun. The surgeon dressed it, but on the second dressing he perceived something hard; on examining it, he found it was metallic, and getting hold of it with his forceps, he pulled it out, when, to his surprise, he found that it was the breech of the gun, which had been forced backwards by the recoil, and been jammed into the orbit. Notwithstanding this extensive injury, which totally annihilated the eye, the man had a perfect recovery.

Mr. Liston, of Edinburgh, related to me the case of a man who, while blasting the roots of trees, had a splinter driven into the eye, which, from its length, must have passed through the foramen opticum, and penetrated into the brain. Mr. L. removed it long after, and the man recovered.

Another more extraordinary case, which also involves, not only injury of the eye, but of the brain, was related to me by a gentleman who attended the patient. In a duel in the West Indies one gentleman hit another in the eye, the ball of which was completely obliterated, and the leaden bullet,

of the transparent cornea always leave a scar, and intercept vision. Wounds of the iris cause a loss of sight, and if the instrument penetrates to the vitreous humor, the eye is left empty, thus combining blindness with deformity.* Wounds of the nose from a cutting instrument leave great deformity, and particularly if the cartilaginous part be injured; if inflicted with a round instrument, or by a blow, it may not only be crushed, but the sense of smell may be destroyed. The ethmoid bone has been driven in this way upon the brain.† Lastly, a sharp-pointed instrument has sometimes penetrated

passing in through the orbit, came out in front of the external ear. Notwithstanding which, the officer recovered with the same facility as if he had only undergone the infliction of a flesh wound.

Sometimes balls find their way into the lower part of the orbit, or somewhere behind the ball of the eye, and deprive it of sight altogether. I saw an instance of this in Canada. Lieut. Gray, my brother officer, received a shot in the left cheek; the ball lodged behind the right eye, and totally deprived him of the use of it. What renders this case the more extraordinary is, that though the shot, which was a small one of that kind known by the name of "buck-shot," and which the Americans introduced in warfare, must have either penetrated through the nose or through the brain. No bleeding at the nose followed the wound, and the only appearance by which it could externally be known that the ball had injured the eye was that it was very much inflamed and blood-shot for some days. When these appearances went off, he was completely deprived of sight in the right eye, and something like a squint, or at least a want of power in moving that eye in concert with the other, remained ever after. (DUNLOP.)

The reader will derive much useful information on this point, by consulting "Cases and observations illustrative of the fatal effects of punctured wounds and injuries of the orbit," by Dr. John Scott, in *Edinburgh Med. and Surgical Journal*, vol. lxii. p. 359.

* Dr. Monteath mentions a case of a person attempting to separate two persons who were fighting, and who received a blow on one of his eyes. The eyeball was burst, and vision entirely destroyed. (*Medico-Chirurgical Review*, vol. ii. p. 640.)

A blow on one eye, accompanied with ecchymosis, will, according to Devergie, affect the other, after a day or two, in a similar manner. He relates two cases of this description, in which the eye, which had not been touched, became black, and bore all the marks of violent injury. (Vol. ii. p. 125.)

† "A man was killed by a blow on the nose; the consequence of which, in the interim, was, that the lower jaw could not be opened, and, in the opinion of the surgeon, he died from inanition, sixteen days after the accident. He was also unable to perform the usual natural evacuations. There was no fracture about the head, and the external wound had nearly healed up." (Smith, p. 254.)

the nose, touched the brain, and hence proved fatal.* Wounds of the external ear are unaccompanied with danger, but the deformity is a serious one. Wounds of the internal ear may either destroy hearing, or from their vicinity to the brain prove in themselves dangerous.† Wounds of the lips, if there be a great loss of substance, not only deform, but are injurious to the speech, and are sometimes accompanied with a constant flow of saliva. Wounds of the ranular artery sometimes occur in children from dividing the frænum, and where the hemorrhage cannot be suppressed they have been known to be fatal.‡ Wounds of the parotid gland are always tedious in curing, and they sometimes become fistulous.

In all cases of wounds of the face the physician should state in his report the degree of deformity that has been produced.

Wounds of the neck also vary greatly as to their danger. Wounds of the integuments and muscles of the neck may be considered simple wounds; but it must be added that they generally heal with difficulty, in consequence of the mobility

* Blows on the nose, which have the effect of fracturing the bone, produce frequently, not only personal deformity, but ultimately loss of the power of smelling, and sometimes an insufferable stench, proceeding from the diseased state of the bone inside of the nose, called by the French surgeons, *punais*, which has the effect of rendering its unfortunate victim quite unbearable in society. I had a case of this kind under my charge while in the army. The patient was a lad of the name of Tobin, who, though I tried every mode of recovering him, was ultimately obliged to be discharged from the regiment, because the stench he created was so intolerable, that it was found impossible for any one to sleep in the same barrack-room with him. He had received an injury which had beat in the bones of his nose previous to entering the regiment; but so far as I am aware, the disease broke out afterwards. (DUNLOP.) [Cases of this sort are usually the indirect result of the venereal disease.—J. W.]

† A fatal case, caused by the insertion of a knitting-needle into the internal ear, is mentioned in *Medico-Chirurgical Review*, vol. xxxiii. p. 246.

‡ Wounds of the arteries of the cheek, internally, sometimes prove dangerous, from the bystanders not having skill or presence of mind enough to stop the bleeding by the very simple means of placing the finger inside of the mouth, and compressing the artery against the thumb externally. And instead of this, they generally resort to the application of styptics and charpie. A young lady in the west of Scotland nearly lost her life from this mode of treatment. Wounds of the artery, sometimes cut in dividing the frænum of the tongue, are easily commanded by squeezing the divided end in a cleft twig covered with lint. (DUNLOP.)

and looseness of the parts.* Transverse cuts may indeed prove dangerous, and affect the motions of the head, or of the pharynx or larynx, and thus prove an impediment to the due exercise either of speech or deglutition. Wounds of the carotids and internal jugulars are generally fatal,† since it is often

* There is a remarkable case of sudden death, from the division of the external jugular vein alone, related in the Boston Medical Magazine, vol. iii. p. 117. The individual was in prison waiting his trial for piracy. He awoke in a state of delirium, attempted to strangle himself, but failing in this, went to the window, and broke out a piece of glass, and wounded himself with it, just under the angle of the lower jaw. Then, by a rapid succession of cuts, he extended it from side to side, but fell immediately into the arms of his companion, and, after gasping two or three times, was dead. He had not lost more than a pint of blood.

On dissection, neither the trachea nor any of the arteries or nerves were found injured; and nothing but a divided vein was seen, and which was probably the principal external jugular. The reporter (Dr. Flint, I presume,) suggests whether this sudden death may not have arisen from the admission of air into the vein.

Mr. Watson (page 93) relates several cases of death from hemorrhage in the neck, without the larger arteries or veins being divided. In one instance, the superior thyroid arteries alone had been divided.

† There is one instance, and only one, of a divided carotid not proving fatal. In this instance, Mr. Carpue, of London, being called at the moment, secured the vessel. (DUNLOP.) The case of Gen. Arrighi, Duke of Padua, may be added. He was wounded by a musket-ball, at the siege of Acre, by which the external carotid was cut across near the place where it is given off by the internal, and as it enters the parotid. The gush of blood from both apertures attracted the attention of the artillerymen, and one of them instantly pushed a finger into each opening, and thus arrested the flow of blood. Baron Larrey was immediately called, and by maintaining pressure saved the life of the patient. (Larrey's Memoirs, vol. i. p. 176.) Some other cases are given by him in his later editions. There is also an instance of recovery, probably from a wounded carotid, given by Delpech. (Medico-Chirurgical Review, vol. vii. p. 244.) Another, by Mr. Garret, in the Midland Medical and Surgical Reporter, vol. ii. p. 235; and a fifth, by D. A. T. Thomson, related in his Lectures in the Lancet, N. S., vol. xx. p. 148.

Sudden death from a blow on the jugular vein.—At Portsmouth, England, a woman aged fifty, came to her death in the following manner. Deceased was a married woman, but lived with a young man named Tucker. They were returning home in the evening, quarrelling. She was suddenly observed to be struck by some one, and was seen to run into the road and drop, screaming. She was immediately taken up by some lookers-on, and conveyed to her lodgings, but she never spoke more, and expired on the following evening. Suspicion fell on Tucker. He was arrested. A very protracted investigation was held before the coroner's jury, which ended in a verdict of manslaughter.

impossible to procure the necessary assistance in time to check the mortal hemorrhage, and for this reason lacerated wounds of these are not so soon fatal as clean cuts.* Wounds of the pharynx and œsophagus are peculiarly dangerous, as other important parts are generally divided along with them; but even if injured alone, as from stabs or gun-shot wounds, they are much to be dreaded, since the nourishment of the system must be carried on through them, and the action of deglutition is directly opposed to a speedy adhesion of parts.† Even

The surgeon who examined the body, pronounced it to be in a very healthy state, none of the usual signs of an irregular life being visible. The whole system and brain (with the exception of an effusion caused by the blow) were perfectly sound. The blow took effect upon the neck over the jugular.

The editor mentions an additional instance, furnished by a gentleman high in the medical staff of the East India Company's service. Two fine healthy young men, in one of the Company's European regiments, were sparring for amusement, when one hit the other a heavy blow on the side of the neck over the jugular vein. The young man thus struck dropped down, and instantly died. On examination, a large quantity of effused blood was found in the lateral ventricles, as also in the fourth ventricle. (*Lancet*, January 11, 1845.)

* But even the latter may be compatible with a very short continuance of life, and even some powers of locomotion. At least, this would seem probable, from the following case, mentioned by Professor Amos, in his *Lectures on Medical Jurisprudence at the London University*:—

At the Warwick assizes (1832) John Danks was tried for the murder of Mary Green. After conviction, he confessed that he had cut her throat with a knife in a hovel, and the surgeon found a wound seven inches long and three in depth, dividing the trunk of the carotid, and all the principal branches of the external carotid and jugulars, yet, in this state, it would appear, that she ran twenty-three yards, besides crossing a bar gate, three feet ten inches high. At this distance, at least, the body was found, and the criminal persisted to the last in denying that he had touched her except in the hovel where he left her for dead. A gentleman went over the ground after the trial, and it took him about thirty seconds. Scarcely any blood was observed in the intermediate space, and this is explained by supposing that she closed the wound with her cap, and also by holding down her head. Much blood had, however, flowed down her breasts, and lodged about the pubes. In the hovel, also, a large quantity was observed. (*London Medical Gazette*, vol. x. p. 183.)

A case in which the internal jugular was partially divided with a razor, and yet the patient saved, is given by Dr. Morgan, of Geneva, in *American Journal Medical Sciences*, vol. xviii. p. 330. He refers to two other successful cases, by Dr. Stevens, of New York, and Dr. Gibson, of Philadelphia. The last, however, occurred during an operation.

† Larrey relates of a grenadier wounded in Egypt by a bayonet, that the

wounds of a portion of the fibres surrounding the oesophagus are dangerous, inasmuch as they produce a weakness of the action of deglutition, and also by the inflammation that sometimes supervenes, tend to induce compression on the trachea. Wounds of the larynx are serious injuries, as they derange or weaken the voice.* A wound of the recurrent nerve alone on

broken point of it remained, for six weeks, deep in the left side of the pharynx, behind the arch of the palate. On its extraction, which was effected with great difficulty, the voice, which had been entirely lost, was instantly restored. (*Medico-Chirurgical Review*, vol. xviii. p. 474.)

A remarkable case is related by Dr. Porter, of New London, in which the pharynx was completely divided above the larynx. It was an attempt to commit suicide. The patient recovered, with the loss of the os hyoides, and a portion of the epiglottis cartilage by sloughing. (*American Journal Med. Sciences*, vol. xxi. p. 303.) [The pharynx is often divided in attempts at suicide. Such wounds usually do well, if no important blood-vessel is injured. The act of deglutition does not prevent the healing of a wound; and deglutition, though impeded, is not usually impossible; or if impossible, for a few days, may be obviated by artificial means.—J. W.]

* A Prussian major was wounded in the larynx by a musket-ball. The wound healed, but the voice was lost. He recovered it, however, gradually, in the course of a year. Case by Dr. Francke. (*Quarterly Journal of For. Med. and Surg.*, vol. i. p. 288.)

Sudden death from a mechanical cause.—The following case is valuable as showing the necessity of a medico-legal investigation in every instance of sudden death:—

Dr. Jackson, of Leith, was sent for at 3 A. M. to visit a person who was said to be either dead or in a fit. He found him dead. The countenance was pale, with a haggard expression, and the pupils were dilated. On looking into the mouth, a small quantity of matter, evidently ejected from the stomach, was seen lying on the tongue.

The deceased had been very intemperate. He had dined the day previous on boiled potatoes, with broth, and in the afternoon drank a quantity of over-proof spirits, and which, indeed, was considered to be the cause of his death. In the evening he was brought home very drunk. He vomited a good deal, and was put to bed by his brothers and mother. The latter awakening during the night, rose to see how he was, and found him in such a state as to send for the physician.

Dr. Jackson was naturally led to suppose that either excessive intoxication or apoplexy had been the cause of his sudden death. And on examination, the brain was found congested—so also the lungs—while the left side of the heart was contracted and empty, and its right dilated, and full of dark fluid blood. There was, however, no marked cause for these appearances yet observed, until he proceeded to open the trachea. Here a piece of potato skin was found, entangled between the folds of the thyro-arytenoid ligaments, and

one side seriously affects this organ, but if both be divided, a complete muteness will follow. Injuries of this description, however, if not of a complicated nature, cannot be considered mortal. Penetrating wounds of the trachea are always dangerous, since, from its never being in a perfectly quiet state, it is difficult to produce a speedy reunion.* Numerous cases, however, prove that a partial transverse division is not mortal, but it is allowed that a complete division is generally so;† more, however, from the vessels that must be divided to accomplish this, than from the injury itself.‡ Wounds of the

completely closing the *rima glottidis*. It had evidently acted as a valve, and thus caused suffocation.

This substance was probably brought up in the act of vomiting, and being of a light nature, was drawn into its present position, from which the deceased was not able, in consequence of his deep intoxication, to cough it up.

Dr. Jackson justly observes, that if the person had been found dead in a house of ill-fame, or had been previously quarreling, suspicion might unjustly have fallen on innocent individuals. (*Edinburgh Med. and Surgical Journal*, April, 1844.)

* A fatal case of rupture of the trachea by a kick, is mentioned in the *Edinburgh Medical and Surgical Journal*, vol. xviii. p. 412.

† A case occurred in the neighborhood of Glasgow, where the trachea was totally divided by violence. A boy driving the gin of a coal pit, placed himself on the end of the lever. On stretching out his head to look at something, his throat came in contact with a post; such was the force with which he was going round, that the trachea was ruptured across. He survived for several days, but in great agony. (DUNLOP.)

‡ There are, however, cases mentioned by surgical writers, in which the trachea was completely cut asunder, and even the œsophagus opened without any wound of the carotid artery. (*Dorsey's Surgery*, vol. i. p. 69.) The following are references to cases in which both the trachea and œsophagus were divided:—

Edinburgh Medical and Surgical Journal, vol. xvi. p. 353. The case did not terminate fatally, although the parts did not unite.

Coxe's Medical Museum, vol. iv. p. 24. By Dr. Van Cleve, of Princeton. A blacksmith thrust his red-hot nail-rod at a man, and perforated both the trachea and œsophagus. Died in a few hours in attempting to swallow.

Lancet, N. S., vol. v. p. 309; and *Maryland Medical Recorder*, vol. ii. p. 241. Case by Professor Luders, of Kiel; attempt to commit suicide with a curved knife; no large blood-vessels or nerves wounded; the parts gradually united. *Ibid.*, vol. xxii. p. 735, by Mr. Toogood. The carotids untouched. The patient survived.

Hennen's Military Surgery, p. 291. Case by Dr. James Johnson, seen at Prince of Wales' Island in the East Indies. A Malay cut his comrade's throat

par vagum, either on one or both sides, are absolutely fatal. Fractures of the cervical vertebræ are highly dangerous, and if the spinal marrow be injured they are fatal.* Luxation of

while asleep; the larynx divided, and also half of the œsophagus; supported by enemas, and gradually recovered.

Case of wounded trachea and œsophagus with a razor, by Dr. Neumann, where the patient survived fourteen days. (London Medical Quarterly Review, vol. iii. p. 299, from Graefe and Walther's Journal.)

"The following case was communicated to me by my friend, Mr. Marshall, author of a work on the Medical Topography of Ceylon, under whose charge the patient was: When the Indian army was sent to Ceylon, during the mutiny in that country in 1818 and 1819, a native cooly or laborer, who followed the camp, was shot through the throat, the ball dividing the windpipe and œsophagus both together. He lived for some days after in a state of the most dreadful and excruciating suffering; the contents of the stomach, or the food he attempted to swallow, choking up the windpipe and producing violent fits of coughing, which threatened him with instant death from suffocation. His breathing was so loud that it could be heard outside of the tent where he lay." (DUNLOP.)

* A remarkable case was stated by Soemmering, in 1793, of a patient in whom there was a fracture and luxation of the vertebral column. He suffered extreme pain, and his extremities gradually became gangrenous—but he survived five months. (Metzger, p. 320.) See an analysis of Casper, on Wounds of the Spinal Marrow, by Dr. Geddings, in American Journal of Medical Sciences, vol. vi. p. 192.

Mr. Philips (in Medico-Chirurgical Transactions, vol. xx. art. 5.) gives a case of fracture and displacement of the atlas, from a fall, in which the patient survived forty-seven weeks. Motion and sensation were unimpaired to the last; and the only difficulty was, that he was unable to rotate his head. He died of effusion in the thorax. See also, Sir Benj. Brodie's observations on injuries of the spinal cord, in *Ibid.*, art. 9. He particularly notices the dangerous effects of concussion, and the softening process to which it gives rise.

Also, a case where the patient survived a year, (from Forriep's Notizen,) in American Journal Med. Sciences, vol. xxiii. p. 236. [A remarkable case of fracture of the odontoid process of the axis, in which the patient, a milkman, continued to attend to his daily occupation from a few days after the accident, which occurred on the 12th of August, 1852, till the day before his death, which occurred on the 12th January, 1853, a period of five months, is reported by Dr. Willard Parker, in the New York Journal of Medicine, for March, 1853. Dr. P. collates this case, with others, from the records of surgery.—J. W.]

Injury to the vertebræ and spinal marrow, not fatal until seven years after.—I do not recollect that the following case is mentioned in the common works on surgery, or that it has found its way into medical periodicals. I copy the principal particulars from Dodsley's Annual Register for 1840.

1840, April 8. W. S. Poyntz, formerly member of Parliament, and aged

the neck is generally fatal from pressure on the same part.* Wounds piercing the vertebræ, or passing between them, are

seventy-one years, died suddenly at his house, when at dinner, with convulsive movements of the face and hands, the consequence of the want of power in the heart to carry on its circulation. This was the result of an injury received in 1833. He then fell from his horse on his head, when his chin was forced on his breast, and produced a dislocation of the spine, which was found on the examination made by Mr. Liston and Mr. Holberton, his medical attendants. Since that accident, he had never been so well as before, and, during the last two or three years, had occasionally experienced brief faintings from a total cessation of the heart's action, presenting symptoms precisely similar to those which occurred the last time. The surgeons found the *processus dentatus* displaced, diminishing the spinal canal, and consequently the spinal cord, one-third in diameter, just below the skull, where the cord begins to meet the brain. It was proved that Mr. Poyntz was apparently better than usual on the day of the fatal attack, although he was rather depressed in spirits. He had taken nothing unusual, nor been from home on that day. He always lived by medical rule. When the fainting fits came on, stimulants and dashes of cold water on the face were formerly used, but the surgeon directed the former to be discontinued, as they did not lessen the duration but rather increased it; and as the attacks were more frequent when the stomach was disordered, it was desirable to withhold spirits and medicinal stimuli on account of their subsequent injury to the stomach. It is singular, that no paralysis or injury of the intellect followed the injury of the spine, in 1833. All the valves of the heart were healthy, and no unnatural sounds were ever detected in the chest. The *dura mater* was found firmly attached to the skull, and there was effusion under the arachnoid membrane. When well, the pulse counted about twenty-five or twenty-six in a minute, at other times not more than eight or nine.

Lasalle relates an instance of rupture of the spine, (between the fifth and sixth cervical vertebræ,) in a maniac, by a violent muscular effort. Death followed in thirty-six hours. (*Gazette Médicale*.) *British and Foreign Med. Review*, vol. xiii. p. 542.

Recovery is sometimes had in cases of fracture of the spine *below* the middle dorsal vertebræ. See *American Journal Medical Sciences*, vol. xvi. p. 381; *Transactions Provincial Med. Association*, vol. v. p. 78.

* Dr. Spencer, of Ticonderoga, relates a case of this kind in a man who fell backwards in attempting to scale a fence. The *dentatus* was luxated anteriorly on the third cervical vertebræ. He lost all sensation below the head, but preserved his speech and mind to the last. He died in forty-eight hours. (*Boston Medical and Surgical Journal*, vol. x. p. 173.)

There is a case related of cure of dislocation of the cervical vertebræ, by Dr. Schuck, of Vienna, in *Edinburgh Medical and Surgical Journal*, vol. lv. p. 554.

A remarkable instance of division of the lower dorsal vertebræ, by falling on a chisel, and which entered five inches, is given in the *New York Journal*

suddenly mortal. Injuries of the neck from contusions are always dangerous, and should they end in death, must be judged of by the appearances that are found on dissection, as extravasated blood, laceration, etc.*

In connection with injuries of the vertebræ, it must be recollected that caries of the atlas and dentatus may have been going on for some time, and death finally and suddenly ensues from spontaneous dislocation of the ligaments. Dissection will, of course, explain any difficulty, but during life, "the extreme emaciation and weakness, the peculiar expression of the countenance and fixity of the head, either quite *erect* or quite *horizontal*, and never moved without the support of both hands," serve to indicate the nature of the complaint.†

Wounds of the thorax are divided into external wounds, into penetrating wounds, unaccompanied with injury to any of the organs in that cavity, and into penetrating wounds, with lesions of those organs.

External wounds from a cutting instrument belong to the class of simple wounds, but from contusions or falls, may become dangerous, either through the extension of inflammation to the internal parts, or from the rupture of some blood-vessels. Fracture of the ribs, if not complicated with their sharp points pricking inwardly, is not absolutely dangerous, although there is even then some impediment to respiration, and some apprehensions of inflammation. But should the rib be much splintered, and the points not be reducible, it may end fatally. Penetrating wounds are not in general dangerous, unless combined with fracture of the ribs, [perforation of some internal organ,] or rupture of some blood-vessel. Internal hemorrhage or emphysema, is often a dangerous and even fatal symptom.

of Medicine, vol. v. p. 165. Paralysis ensued, with other symptoms; but of these the patient gradually recovered, and, although probably somewhat of a cripple for life, he has since married, and has one child.

* An instance of a very severe wound of the neck, occurred in the case of Gen. Ripley, wounded in the sortie from Lake Erie, in 1814. An account of it, with the narrative of his recovery, by Dr. E. L. Allen, will be found in the Transactions of the Physico-Medical Society of New York, vol. i. p. 85.

† A case of this description is related by Prof. Syme, in Edinburgh Med. and Surgical Journal, vol. xlv. p. 8. [I have met with a similar case.—J. W.]

Wounds of the lungs are dangerous, and the prognostic is always doubtful, when the injury has been inflicted at the upper part of the thorax, or at the posterior side, near the junction of the ribs with the vertebræ. The symptoms here require the strictest attention, as no case should be despaired of.* These organs are also subject to concussion, which is termed *wind concussion*, and is usually fatal. Fractures, luxations, and contusions of the vertebral column, are all highly dangerous, and may sooner or later prove fatal.

It is difficult to conceive of the pericardium being wounded without a correspondent injury of the heart. But, if separate, it is to be deemed a highly dangerous wound.† Wounds of

* A very extraordinary case of this kind came under my care some years ago. Sergeant Verdey, of the 89th regiment, at the battle of the Falls of Niagara, received a shot on the breast, about an inch and a half on the right side of the sternum, which came out behind about the same distance from the spine; the lungs were completely penetrated, and the air passed through both apertures. On his being brought to me, I thought the wound must necessarily prove mortal; and having a great many wounded to attend to, I merely dressed it with lint, but secured by straps. Next day, instead of finding him dead, as I expected, I found that he was easier, and that fever had commenced. I bled him freely, and paid particular attention to him; and in the course of a fortnight he was so well as to be fit to be removed to the general hospital at York. He afterwards recovered completely.

Mr. Maiden's case of the man who was transfixcd through the thorax by a gig shaft, must be fresh in the memory of every medical man. (DUNLOP.)

A very similar case of a gun-shot wound, where the charge passed from the navel to the back, and the patient recovered, is related in the Provincial Med. and Surgical Journal. (New York Journal of Medicine, vol. iv. p. 112.)

Dr. Tait mentions a case of rupture of the lung, from external violence, (being run over by a parcel van,) in a child three years old. She died in thirty-five hours. There were *no external marks of injury on the chest*, but the symptoms were severe. (Quoted from the Northern Journal of Medicine, in the Lancet, July 20, 1844, p. 531.)

† Larrey mentions several cases which he deemed wounds of the pericardium, and that were cured. Sir A. Cooper relates one where the wound was inflicted with a reaping-hook, and the patient survived two or three weeks. (Lectures, vol. iii. p. 169.) [I have seen one case in which there was reason to believe that the pericardium was punctured, and which ultimately recovered. Larrey and others have advised puncture of the pericardium, for the relief of dropsical effusions into its cavity, and the operation has, I believe, been successfully performed; the point of election for the puncture where the pericardium is most accessible, being a little to the left of the median line, at the point of junction of the diaphragm with the ribs.

the heart, of its ventricles and auricles, are mortal: but it is remarkable that numerous cases are on record where life has been prolonged for a considerable time after the infliction of the injury. Bohn quotes several cases of the kind,* and an instance occurred in the British army in Spain, some years since, where a soldier survived for thirteen days with a musket-ball in his heart.† The reason in some of these cases is, that the instrument which causes the wound, prevents, by its closing the aperture, the fatal hemorrhage which otherwise would soon

Dr. Alonzo Clark presented to the New York Pathological Society a preparation which I had an opportunity of witnessing, in which the pericardium had been opened from the œsophagus by erosion. The accident had occurred to a patient at Bellevue Hospital, who, while asleep, had accidentally swallowed his set of false teeth. The irregularly-shaped mass, lodging low down in the œsophagus, ultimately worked through into the pericardium, where it excited extensive inflammation, which eventuated fatally.—J. W.]

* Pages 26, 221, 222.

† Instances of people living for any period, longer or shorter, after the heart has received a severe injury, are to be found in every work on forensic medicine, and these are not to be looked upon merely as physiological curiosities; they sometimes involve questions of life and death.

A case was tried in Glasgow, in 1819, of which the following is an outline: The keeper of a house of bad fame in Greenock, was indicted for the murder of a sailor, by shooting him through the chest. It appeared from the evidence of the medical witnesses, that the auricles, and part of the aorta next the heart, were shattered to atoms by the slugs and brass nails with which the piece was charged; and in their opinion, he must have dropped down dead the moment he received the shot. Therefore, as the body was found in the street, and the door of the house was eighteen feet up an entry, it followed that the prisoner must have run into the street and there shot him. For the prisoner, it was urged and proved, that he had shot him through the door of his own house, which he was attempting to enter by force. And besides, direct testimony from those within the house, and from a lad who was along with the deceased at the time, it came out in evidence that there was a stream of blood from the door of the house to the spot where the body was found, which could not have run from the body toward the house, as the threshold of the door was on a higher level than the pavement of the street. On this evidence, the prisoner got a unanimous verdict of acquittal. (DUNLOP.)

I subjoin Mr. Taylor's comments on this narrative: "If by the heart being '*shattered to atoms*,' we understand that its cavities were entirely laid open, and its substance destroyed, we have a description of wound which most professional men would not hesitate to pronounce instantaneously mortal. The existence of an individual after such an injury, for a period sufficiently long to enable him to run eighteen feet, must be regarded as almost miraculous." (Medical Jurisprudence, p. 452.)

follow. In other cases it may be the clot. Formidable however, and imminently dangerous as these wounds are, it is not to be denied that probably some have survived an injury of the heart. "There is reason to believe," says Dr. Dorsey, "that the heart has often been slightly wounded without fatal consequences."*

* On this interesting subject of wounds of the heart, I have collected some references which may be of use to the medical witness. The case in the text of the soldier in Spain, is in the *Edinburgh Medical and Surgical Journal*, vol. xiv. p. 129:—

Triller in *Schlegel*, 5, p. 242: a wound fatal after fourteen days.

Pelletan's *Surgery*: The aorta wounded with a small sword, yet the patient survived two months.

Medical Records and Researches, p. 59. Case by Dr. Babington: The right ventricle and both lobes of the lungs penetrated by a bayonet; survived nine hours.

Medico-Chirurgical Transactions, vol. ii. Case by Mr. Featherston: ventricle wounded by a bayonet, but the patient walked about the ward on the second day. He died in forty-nine hours.

Medico-Chirurgical Review, vol. xiv. p. 463. Case by Boyer, at La Charité: Wound of the left ventricle with a knife; died in nine days.

American Journal of Medical Sciences, vol. xv. p. 532. Case by Dr. Fris, at Naples; survived a wound of the ventricle with a knife, ten days.

New York Medical and Physical Journal, vol. v. p. 314. Case by Professor Stevens: Wound from a needle: the pericardium was punctured in ten or twelve places, and the right ventricle lacerated. No doubt the beating of the heart against the head of the needle caused these punctures. Death ensued in a few hours.

Medico-Chirurgical Review, vol. x. p. 245. Case by M. Ferrus: A maniac wounded himself with an iron stilet; survived twenty days; and on dissection, the instrument was found strongly fixed in the substance of the left ventricle. The case is also given in detail by Orfila, *Leçons*, second edition, vol. ii. p. 480.

Ibid., vol. xxii. p. 453. Case at Hôtel Dieu; right ventricle wounded with a kitchen knife; survived a month.

Ibid., vol. xxiii. p. 84, Dupuytren's cases.

Transactions Provincial Med. and Surgical Association, vol. ii. p. 357; a boy, ten years old, discharging a wooden gun, was wounded in the thorax, by a plug of wood, about three inches long, which he had used to form the breech of this apparatus. It could not be found. He walked about for a fortnight, and said he was well, but finally wasted away, and died in five weeks and two days after the accident. On dissection, the stick was found in the right ventricle, forcing itself between the columnæ carneæ and the internal surface of the heart, and incrustated with a thick coagulum. No wound could be discovered in the heart or pericardium. It is hence doubtful whether this was actually a wound of the heart, and it is supposed by Mr.

Davis, who relates the case, that the stick at first entered the lung, and passed into the vena cava, and thence was carried by the stream of blood, first into the right auricle, and then into the right ventricle.

Western Journal of Medical and Physical Sciences, vol. ix. p. 382. An individual was shot with a pistol-ball of the size of seventy-four to the pound. He pursued his antagonist some rods, but became faint and fell. He survived ninety-seven hours. On dissection, the ball was found to have entered the right ventricle, passed to the right auricle, through the tricuspid valves, and then descended into the vena cava ascendens, in the right iliac portion of which, about half an inch from its bifurcation, it was found lodged. Case by Dr. Simmons.

Lancet, N. S., vol. xx. pp. 208, 235. Two cases by Mr. Lees (from Dublin Journal.) One was of an officer, wounded in the right auricle with a sword in a duel. It was fought on shore, and the individual returned on board ship without expressing any material uneasiness. The surgeon supposed that the broken point of the sword had been lost in the grass. Death ensued on the next day.

In the other, a brewer's man in Dublin fell under his dray, which passed over his chest. He recovered so as to drive his horse for an hour, when, being near Stevens' Hospital, he thought he might as well be examined. He walked in and lay on a bed, but in turning on his side, he suddenly expired. On dissection, the fifth rib was found fractured, and a portion of it had penetrated the pericardium and right auricle. It filled up the perforation of the pericardium, but had freed itself from the heart, and this last, probably, occurred immediately before death.

The same author (Mr. Lees) states that out of 54 cases collected by M. Ollivier, the right ventricle was the seat of the wound in 29, the left ventricle in 12, both ventricles in 9, the right auricle in 3, and the left in 1. Out of 29 cases of penetrating wounds of the cavities of the heart, only two proved fatal within 48 hours; in the others, from 4 to 28 days.

Sedillot (p. 243) relates of a young student of medicine, who, desirous of destroying himself, inflicted a wound with a double-bladed knife in the cardiac region, and afterwards divided the crural vein. On dissection, the left ventricle was found to be penetrated, but the hemorrhage was so slight as clearly to indicate the other wound as the cause of death.

Lancet, N. S., vol. xxiv. p. 605, (from the Calcutta Quarterly Journal) A suicide survived four days, after having wounded the heart through and through with a paper scraper of ebony, which was found in it.

British and Foreign Med. Review, vol. vii. p. 255 (from Casper.) An individual stabbed in the right auricle lived seven days.

Edinburgh Med. and Surgical Journal, vol. liii. p. 528, (from *Archives G n rales*.) Three cases of penetrating wounds, related by M. Jobert, where the persons lived from twelve hours to ten days.

Lancet, N. S., vol. xxvi. p. 421. Mr. Alcock mentions an instance where a musket ball penetrated the heart, and the man lived forty-eight hours; and Mr. King, one of a robber, stabbed with a bayonet which transfixed both ventricles, and yet the man was able, with a musket in his hand, to jump over two high fences. He then fell down suddenly and died. Some blood was found in the pericardium.

Let it not, however, be supposed from these examples, that wounds of the heart are not *suddenly* mortal. Individuals often die either instantly after a wound, or life is only protracted for a few minutes.

In the case of Mrs. Hamilton, murdered by Clough in 1833, at Bordentown, New Jersey, by repeated stabs with a dirk, seven wounds penetrated the left lung, and three entered the left ventricle. She walked some distance down stairs after this, and held some conversation, but soon fell, and died in fifteen minutes.

Robert Cully, the policeman stabbed through the heart in London, May 14, 1833, ran thirty yards, and then exclaiming, "I am very ill," fell down and expired.

Mr. Wallace, of Dublin, in a clinical lecture on Diseases of the Heart, mentions three cases of a similar kind. In the first, the pulmonic artery and the aorta within the pericardium were wounded by a spear-pointed, double-edged instrument. The person fell, and expired after uttering a few words. In the second, the right ventricle was perforated by a knife. Instant death. In the last, where the left ventricle was pierced, death ensued in fifteen minutes. Although thus sudden the bodies soon became stiff.

Mr. Wallace agrees with the medical witnesses in the Glasgow case, and does not believe that the wounded person, if the injury detailed be correctly reported, could have walked the distance stated. He thinks it more probable that the blood was deposited for the purpose of deception. Still he allows that in certain injuries of the heart, life may be somewhat prolonged. (*Lancet*, N. S., vol. xiv. p. 140.)

By Dr. Casper.—Wound with a common dinner knife, blade three and a half inches long and three-fourths of an inch broad. A man stabbed his wife with this up to the hilt. Died instantly. The wound passed right through the upper part of the sternum into the arch of the aorta and the right lung. The bone was clearly pierced without any fracture or splintering. (*British and Foreign Med. Review*, vol. xiii. p. 542.)

By Dr. Gilman.—A case in New York. Wound with a common table-knife; it passed through the sternum without any fracture or splintering, and penetrated the right auricle. Death was nearly instantaneous. (*New York Med. Gazette*, vol. ii. p. 351.)

A Spanish refugee was struck in the back with a knife. The blade broke at a little distance from the skin. The patient walked to the hospital, where he died two hours after. It was found that the knife had penetrated between the seventh and eighth dorsal spines, that it had cut or broken one of these processes, crossed obliquely the vertebral canal, traversed the body of the vertebra from below and a little to the right side of the centre, and then wounded the aorta below its arch. The pericardium was divided to the extent of five millimetres; it contained three grammes of blood. The spinal cord was not affected. (*Bulletin de Therap.*, June, 1842; *London Med. Gazette*, vol. xxxii. p. 880.)

M. Marini publishes a case of a woman wounded with a dagger in the left ventricle, who survived sixty-five days. She was bled, etc. Discharged from the hospital apparently well, but died suddenly three weeks after. Marks of cicatrization were found. (*Medical Times*, vol. x. p. 230; *Edinburgh Med. and Surgical Journal*, vol. lxii. p. 557.)

British and Foreign Med. Review, vol. x. p. 49, (from Malle's Clinical Surgery.) A soldier survived forty-seven days after being wounded by the portion of the stock of a gun that had burst. On dissection, it was found fixed in the left ventricle, and projecting into the cavity of the right one.

Instances of the heart being found cicatrized are given in *Lancet*, vol. vii. p. 22, Bougon's case. *Western Journal of Medical and Physical Sciences*, vol. i. p. 329. Case by Dr. Randall, of Tennessee, of a negro boy, shot in the breast with a fowling-piece. He survived sixty-seven days, and at one time was able to walk about. On dissection, the spots where the shot entered were found cicatrized, and three shots were found in the right ventricle, and two in the right auricle. Dr. Drake, in his observations on this case, refers to other instances. (See his *Journal*, vol. ii. p. 329; and vol. iii. p. 297.)

A case of recovery from a punctured wound of the heart, by a darning-needle, is related by Dr. O'Conner, in *London Medical Gazette*, vol. xvii. p. 82.

A probable case of recovery from wounds of the heart by a knife, by Mr. Henri, in France, is quoted in *London, Edinburgh, and Dublin Monthly Journal of Medical Science*, vol. ii. p. 188.

Death from the introduction of needles into the heart.—A soldier was brought to the Hospital of Lublin, St. Petersburg, screaming with agony from pain, which he attributed to having introduced two needles into the chest in the region of the heart two days previously. His pulse was hard and quick, his countenance anxious, and bathed, as well as his body, in a copious perspiration. Frequent distressing cough, and acute pain in the precordial region, were his most distressing symptoms. Slight crepitous rattle was heard at the anterior and lower region of the left lung; but at other places the respiratory murmur appeared to be natural. The action of the heart was tumultuous, but without particular character. Not a trace of the entrance of the needles existed on the skin of the chest. Copious bleedings with other antiphlogistic measures, were followed, without affording much relief. Hiccough and loss of speech came on the fifteenth day, but he retained his faculties to the last, and died on the nineteenth day.

When the skin was removed from the surface of the chest, two narrow apertures were seen between the fourth and fifth ribs, which penetrated to the cavity of the chest. On laying open that cavity, these apertures were seen to communicate with an abscess which extended into the substance of the lung. The pericardium was very much thickened and filled with a semi-coagulated whitish or puriform matter, similar to the plastic matter thrown out on serous membranes. This matter formed a layer of about two lines in thickness on the internal surface of the pericardium and surface of the heart. The heart adhered so intimately by its base and posterior portion to the pericardium, that it required considerable force to remove it. The pericardium equally adhered by new fibrinous adhesion to the left lung and to the diaphragm. The heart was thickened in its substance, and harder than usual. The inferior margin of the left lung was highly inflamed. The needles were found in the posterior and inferior part of the left lung, having probably made their way to that portion in consequence of the continued movements of the heart and lungs. (*Edinburgh Med. and Surgical Journal*, January, 1843, from *Archives Générales*, July, 1842.)

Wounds of the base of the heart are, however, almost invariably mortal.*

Case by Dr. Leaming.—Needle entered the right breast. Death after various illnesses—pneumonia, spasms of the diaphragm, and pericarditis nine months after. The needle was found protruding in the left ventricle, into which it had passed from the right one. (Medical Examiner, vol. vi. p. 112.) [A similar case occurred in the practice of Drs. Voris and Davenport, of New Rochelle, New York. A little girl died in consequence of a wound in the neck, caused by falling upon a piece of glass, which wounded a large blood-vessel. After her death, a needle, rusted and black, was found in the septum, between the two ventricles. The needle, thus situated, I had an opportunity of examining. How it got there, or when it entered, no one knew. That it might have worked its way through from the œsophagus, is very likely—as in the case of a set of false teeth which passed from the œsophagus into the pericardium, to which allusion has already been made.—J. W.]

Bullet lodged in the heart for twenty years.—In 1840 a boy aged fourteen, was shot in the right shoulder, the ball entering through the upper border of the trapezius, two inches from the acromion. He regained health. In 1845 he had an attack of pneumonia, when, for the first time, the tumultuous action of his heart was noticed. A second attack of pneumonia, in 1860, proved fatal. On post-mortem examination, the heart was found much enlarged, pericardium adherent at the right side, and the bullet imbedded in the wall of the left ventricle.—D. T. Balche, North Lawrence, New York.—Braithwaite, No. 44, p. 104.

* *Rupture of the heart, from external injuries, is rather an uncommon occurrence.* There are, however, several cases. One is of a smuggler, who fell down a cliff about one hundred feet. No other injury was found than a rupture of the right auricle. (Mr. Jeffery, in London Medical Gazette, vol. xxvi. p. 464.) Professor Geoghegan mentions another, in the Dublin Medical Press, of a female struck by the wheel of a jaunting car. She was instantly killed. On examination, not the slightest mark of violence could be discovered, but the heart was ruptured almost throughout its entire length. He refers to additional instances related by Dr. Gairdner, in Edinburgh Medico-Chirurgical Transactions, vol. i. p. 662; and by Dr. Christison, in his Lectures. Dr. John Davy, in his Anatomical and Physiological Researches, gives the case of a person who fell down a precipice of some fifty or sixty feet; and he also refers to a case noticed by Portal, where death was caused by a passage of a wheel over the body. In each there was no other injury than of the heart or aorta. Case No. 1, is also noticed as containing the ruptured parts in the catalogue of the museum of the medical department of the army, Fort Pitt, Chatham, p. 51.

Rupture of the heart from external injury or violence, is probably an extremely rare occurrence. I have only been able to collect the following instances:—

1. A man, aged forty-two, in general good health, was found dead in April, 1823, in a chalk-pit, in the neighborhood of Chatham, England, at the foot of

a precipice between fifty and sixty feet deep, the greater part of it perpendicular. Externally, there was no mark of violence or appearance of contusion. The neck of the right thigh-bone was found to be fractured. On opening the chest, a quantity of blood was found in the left pleura and the pericardium. The right auricle and ventricle, and the left ventricle were uninjured, but the left auricle and aorta were each ruptured, the former in two places. There were no marks of organic disease in any part of the heart. This case is related by Dr. John Davy, in his *Anatomical and Physiological Researches*, and he states, as the result of his examination of authors, that there is but one other case recorded of "rupture of any part of the heart, from a force acting through the medium of other parts, on this organ, apparently free from disease, and in its perfectly normal healthy state."

2. This is noticed by Portal, in his *Anatomie Médicale*. The wheel of a cart, loaded with stones, passed over part of the chest of a young man. Death ensued almost immediately, and the left auricle was found open. Chaussier, who examined the body, attributed the rupture to compression of the aorta by the wheel, and to over-distension of the auricle with blood, the consequence of that obstruction.

3. Dr. John Gairdner, in the *Edinburgh Medico-Chirurgical Transactions*, vol. i. p. 662. The subject was a girl ten years of age. The wheel of a loaded cart passed over her body, and her death was quite instantaneous.

There was scarcely any perceptible impression of the wheel externally, and no subcutaneous extravasation, except a very slight one under the left nipple. Not a rib was broken. The abdomen was perfectly natural. In the thorax, the only deviation from the healthy state was rupture of the heart, with extensive laceration of its substance. Both auricles and both ventricles were laid open by the laceration, and the septum was torn to shreds. About one-half of the substance of the heart had burst a way for itself through the pericardium into the right cavity of the thorax.

4. Professor Geoghegan mentions another in the *Dublin Medical Press*, of a girl, aged seven, struck by the wheel of a jaunting car. She was instantly killed. On examination, not the slightest external mark of violence could be discovered; but the heart was ruptured throughout almost its entire length. Dr. G. refers to additional instances mentioned by Professor Christison in his *Lectures*.

5. Mr. Jeffery, *London Medical Gazette*, vol. xxvi. p. 464. A smuggler was found dead under the cliffs at Sidmouth, having fallen from a height of about one hundred feet. There were a few slight bruises about the body, but no penetrating wounds or fractures. The right auricle was ruptured, so as to admit the little finger. He was an individual in good health, and there were no marks of organic disease.

Rupture of the heart from external violence.—In our number for April last, an abstract was given of five cases of this, all we could then collect. The following interesting case, communicated to the Westminister Medical Society, 23d January, 1841, by Dr. Hancock, may be added to the list. A man, aged fifty, was admitted into the Charing-cross Hospital, on the eighteenth of January, between five and six o'clock in the evening, having sustained severe injury in his chest, in consequence of being compressed between a cart and a wall. On examination, the sternum was found fractured, and several ribs on

the right side dislocated from their cartilages; he could scarcely speak; his breathing was very difficult; his countenance anxious and livid, and his pulse eighty, and regular. He was slightly relieved by the application of a broad roller round his ribs and sternum. Various stimulants were given, and hot water applied to his feet, but his pulse gradually and regularly got lower, and he died at five the following morning. The sternum was found fractured, six of the ribs were dislocated from their cartilages, and the cartilages also displaced from their attachments to the sternum on the right side, an opening being thus formed through which a portion of lung protruded; on the left side the cartilages of the three upper ribs were dislocated from the sternum, and the three lower cartilages were dislocated from the ribs themselves. Much fluid blood was found in the cavity of the thorax, and a large coagulum in the pericardium. The left auricle of the heart was lacerated to the extent of about an inch at its posterior and inferior portion; the lungs were uninjured; and none of the large vessels ruptured. Mr. Hancock thought the case interesting, from the fact of the man having lived nearly twelve hours with so extensive a laceration of the substance of the heart; the man, subsequent to the injury, was obliged to be kept in the erect position; the pulse had not been examined with reference to any difference at the wrists. (*Lancet*, January 30, 1841.)

Case of spontaneous rupture, by Dr. Mayer, (from Kleinert's *Repertorium*,) in *British Annals of Medicine*, vol. i. p. 725; Watson, on Homicide, pp. 95, 96. Thurnam's cases of Rupture of the Heart. *London Med. Gazette*, vol. xxi. p. 813. *Ibid.*, p. 894, two cases by Mr. Curling; in one, death was instantaneous; in the other, the patient experienced great agony for twenty hours before he expired. *Medico-Chirurg. Review*, vol. xxxiii. p. 671. Case by Dr. Stephen, of Elgin. *Lancet*, N. S., vol. xxiv. p. 833. Rupture of the aorta, fatal in three minutes. *London Medical Gazette*, vol. xxvi. p. 559. Case by Mr. Smith, from *Dublin Journal*; death in eighteen hours, from rupture of right ventricle. *Lancet*, N. S., vol. xxvi. p. 420. Cases by Dr. Stroud; death in ten hours from the same; and by Mr. Dalrymple, three, two of which died instantaneously, and the other lived eight days. *London Medical Gazette*, vol. xxvi. p. 904. Dr. Stroud's case in detail. *Ibid.*, vol. xxvi. p. 905, by T. Thomson. See also Copland's *Dictionary*, art. Rupture of the Heart, and an analysis of Dezeimeris' essay on the same, in *Medico-Chirurg. Review*, vol. xxxv. p. 531.

Cruveilhier (*Anatomie Pathologique*, thirtieth livraison,) asserts that the seat of the rupture is exclusively the left ventricle, and nearly always at or near its top. This, however, is not confirmed by other examiners. Out of forty-four cases noticed by Townsend and Bayle, six were ruptures of the right ventricle. (*London Med. Gazette*, vol. xxvi. p. 559.)

Case of Spontaneous Rupture of the Heart. Bouvier, *Bulletin de l'Acad. Roy. de Médecine*, vol. iii. p. 403.

H. T. Taylor.—Sudden death. Rupture of right ventricle. *Lancet*, November 11, 1843, p. 181.

W. Ryan, do.—Rupture of the junction of aorta with the ventricle. *Lancet*, February 17, 1844, p. 688.

Mr. Bodington.—Death in nine hours, after violent pains. Left ventricle ruptured.

Wounds of the aorta and vena cava are fatal.*

It is hardly possible that the thoracic duct can be wounded without affecting other vital parts; but if it should occur, we must deem it fatal, as the chyle, instead of passing in its ordinary course, is diffused into the cavity of the thorax.† For

Mr. Challice.—Death very sudden. Right ventricle perforated. *Edinburgh Med. and Surgical Journal*, vol. lxiii. p. 237.

* See Hays' *American Cyclopædia of Medicine and Surgery*, vol. ii. p. 185, art. *Wounds of the Aorta*, by Dr. Geddings. Wounds of the thoracic aorta, by an iron nail-rod, fatal in three and a half minutes, related by Mr. Smith, in the *Dublin Med. Journal*. (*Edinburgh and Medical and Surgical Journal*, vol. liv. p. 510.)^{*} Dr. Dunlop in his MS. Lectures, mentions that it was formerly the custom in the Portuguese army to punish delinquents by striking them on the back with the flat of a heavy sword, of which the consequences sometimes were rupture of the blood-vessels of the chest, and even of the aorta.

As an instance of a very rare exception to the above general rule, may be mentioned the case of a Bavarian soldier, who was stabbed with a knife in the ascending arch of the aorta, in 1812. He died in 1813, of pneumonia; and, on dissection, the cicatrix was found in the aorta perfectly closed. The knife had penetrated through all the coats of the artery. (*Lancet*, vol. xxii. p. 383, from *Archives Générales*.)

6. Catalogue of the museum of the medical department of the British army, Fort Pitt, Chatham, p. 51. Daniel Hoyland, a maniac, who received a severe fall on the pavement, in consequence of his foot having slipped on some ice, died in about two minutes. The aorta was found ruptured immediately behind the semi-lunar valves, and the pericardium was filled with coagulated blood.

7. A case by Andral. Quoted in *Medico-Chirurgical Review*, vol. xlv. p. 494.

Wound of the thoracic aorta. By Mr. Smith.—A boy, sixteen years of age, was stabbed with an iron nail-rod in a scuffle with a smith who worked in the same forge with him. The instrument entered the left side, between the sixth and seventh ribs, passed through the lung close to its root, and entered the aorta about an inch above the opening in the diaphragm for the passage of that vessel. The boy died about three and a half minutes after the receipt of the injury. About a pint and a half of coagulated blood was found in the cavity of the pleura. The cellular coat of the artery was only partially divided by the instrument, while the middle coat and lining membrane were ruptured throughout their entire circumference. (*Ibid.*, from *Dublin Journal of Medical Sciences*, July, 1840.)

Rupture of the vena cava, from the wheels of a gun-carriage passing over the driver. Death ensued in twelve minutes. (*Lancet*, October 26, 1844, p. 127.)

† Blumenbach refers to a case in Lentin, where life continued, though in a weak state, for many months after a rupture of the thoracic duct. (*Elliotson's Blumenbach*, p. 362.)

similar reasons, the lower part of the œsophagus is scarcely, if ever, wounded separately; but if so, it is certainly mortal, as it prevents the proper passage of the food, and totally impedes the function of nutrition. Wounds of the vena azygos are mortal, as they are attended with a hemorrhage which it is impossible to suppress. Wounds of the diaphragm, if made with a sharp-pointed instrument, such as a sword, are dangerous, if only the muscular parts be injured; but if the tendinous ones are also injured, they are considered fatal.*

* I have taken this distinction from the systematic writers, although I am perfectly convinced of the correctness of a remark of Dr. Marc, that *it is useless to distinguish between wounds of its tendinous and muscular portions.* (Godman's West. Reporter, vol. i. p. 44.) A very curious case of wounded diaphragm, which, from its consequences, proved fatal at the end of eleven months, is mentioned in the Edinburgh Medical and Surgical Journal, vol. viii. p. 42.

Cases of recovery from a punctured wound are given in London Medical Repository, June, 1824, by Mr. Wood; in Lancet, N. S., vol. iv. p. 421, from a stab in the muscular part, by Prof. Bernt. Percy (Dictionnaire des Sciences Médicales, vol. ix., art. *Diaphragm, Rupture of,*) says that when not immediately fatal, patients suffer greatly from it, and on dissection, the edges of the rupture are found callous and rounded.

A case of extensive laceration of the diaphragm, from a fall of forty feet, and which proved fatal in five and a half days, is related by Mr. Curling, in British Annals of Medicine, vol. i. p. 551.

A medico-legal case, in which rupture both of the diaphragm and stomach was present, is mentioned at pp. 116-17 of this volume. The circumstances attending it were such, that I can readily agree with the opinion that this injury happened at some period subsequent to the infliction of the fracture. But in allowing this, it is not necessary to concede, which some have done, that rupture of the diaphragm is in all cases *immediately* fatal. Dr. Johnson (Medico-Chirurgical Review, vol. xxvi. p. 432.) quotes the following from a French journal: A healthy and vigorous man, in attempting to mount a coach, pulled it over, and fell under it. He was taken to the Hôtel-Dieu on the third day of the accident. The right thigh bone was found to be fractured, but no alarming constitutional symptoms were present. The pulse was natural, the respiration not oppressed, and the only annoyance was a teasing cough, with a copious expectoration. He sunk unexpectedly on the *sixth* day, and dissection exhibited a separation of the diaphragm from the sternum and ribs for a considerable extent, and through this the bowels protruded. There was also a smaller rupture of the diaphragm in another part.

The case referred to has given rise to much interesting discussion. Besides the references already given, it is also noticed by Taylor, p. 457; and Devergie, vol i. p. 187.

Mr. Taylor also gives us a case occurring in Guy's Hospital, where the

As a general deduction from these remarks, it may be observed that the prognostic in wounds of the thorax is, in most cases, an unfavorable one, although they are not often mortal unless some primary organs be injured. John Bell, indeed, directs his pupils never to call any wound mortal unless it be plainly a wound of the heart. This advice may be proper in surgery, but it can have no bearing in legal medicine, since it practically excludes all prognostics whatever. I have, therefore, given the best-founded opinions that I could obtain, and will only add that the prognostic in wounds of the lungs should in general be delayed, as the cases of recovery from desperate ones are so numerous that we can never be justified in peremptorily declaring any particular instance a mortal wound. Wounds from fire-arms are, however, always more hazardous than those from cutting or sharp-pointed instruments.*

Wounds of the abdomen, like those of the thorax, are divisible into external and penetrating wounds. The former are

accident causing the rupture must have happened *nine months* before death. The patient was admitted for a diseased ankle caused by a fall; otherwise his health was good. After lingering three months in the hospital, death followed; and, on dissection, an aperture, two and a half inches in extent, was discovered in the muscular part of the diaphragm. The margin of this aperture, to which the omentum was in one or two places strongly adherent, was opaque, yellowish, and even. A large portion of the stomach was found in the cavity of the chest. (Guy's Hospital Reports, vol. iii. p. 366.) See also Dr. John Reid on Diaphragmatic Hernia, in *Edinburgh Med. and Surgical Journal*, vol. liii. p. 104.

Lancet, N. S., vol. xxxii. p. 702. Rupture of the diaphragm from a fall from the rigging on board ship. Death in five days, [Wounds and ruptures of the diaphragm are almost always followed by protrusion of some of the abdominal viscera into the chest; and death I have seen in these cases, delayed many days.—J. W.]

"Three cases confirm the fact I was the first to point out—that wounds of the diaphragm, whether in the muscular or the tendinous part, never unite, but remain with their edges separated, ready for the transmission between them of any of the loose viscera of the abdomen which may receive an impulse in that direction." (Guthrie, *Lancet*, April 16, 1853.)

* Dr. Pliny Earle relates two most astonishing cases of recovery from severe injuries: one in which the pivot of the trysail-mast of a vessel penetrated through and through the thorax; and the other in which the shaft of a gig performed the same operation. The latter is the well-known Maiden case; but Dr. Earle gives us the appearances of dissection eleven years after the accident. (*American Journal Med. Sciences*, N. S., vol. ii. p. 117.)

to be deemed simple, unless they have been accompanied with a violent shock of the system, or are of large extent, or are accompanied with wounds of the epigastric artery. In this last case the hemorrhage has sometimes proved fatal. Penetrating wounds are to be dreaded, either from touching the peritoneum, and thereby causing inflammation, or from producing ventral hernia, and in the latter case the apprehension will be graduated on the nature of the viscus that has passed out, and the inflammation and strangulation that accompany it.*

Penetrating wounds may also strike one or more of the viscera contained in the abdomen, and in that case the accidents that occur, and the medico-legal questions that arise, are among the most perplexing of this branch of our subject. Wounds of the stomach are to be deemed highly dangerous, although there has been great diversity of opinion concerning their mortality. Bohn and Teichmeyer pronounce all mortal, and the instances of escape as almost miraculous; while Alberti, Boerhaave, and Valentini consider those only mortal which have injured the lower part and the two orifices. A wound of the stomach was declared accidentally mortal by the medical faculty of Giessen, and absolutely mortal by the medical college at Frankfort; while in another case a wound was considered mortal by the faculty at Leipsic, and not so by those of Helmstadt and Wurtemberg.†

* The necessity of returning it as early as possible is very manifest; and if this be not done, the criminal may escape punishment, at the expense of the surgeon's reputation. See a case of this kind in Smith, p. 263.

† Mahon, vol. ii. p. 122; Valentini's *Pandects*, vol. ii. pp. 413 to 432. All the writers on legal medicine agree that a wound inflicted on a full stomach is more dangerous than one on that organ when empty. It should, therefore, be a subject of inquiry how long before the injury a meal has been taken. (See *Am. Journ. Med. Sci., N. S.*, vol. xxx. p. 250.)

Instant death from a wound of the stomach. Timothy Daly, a policeman, in attempting the arrest of a robber, was shot by a pistol bullet. He almost instantly expired.

On dissection, a wound of a round shape, and of the size of an English sixpence, was found between the seventh and eighth ribs of the left side, and another on the right side over the last rib. The lungs and heart were healthy and uninjured. The blood was universally fluid, but there was none extravasated into the cavity of the chest. The ribs just named were each found to be fractured. The stomach was removed and examined; it was distended

This contrariety of opinion has arisen from a consideration of the following circumstances: wounds of the stomach have sometimes been cured without any bad consequences; various substances, such as knives, forks, pins, etc. have been swallowed without immediate injury; and the operation of gastro-nomy has been occasionally performed with safety.* All these facts tend to show that wounds of the stomach are not absolutely mortal, but they do not permit us to deny their danger.† Certainly, if inflicted with a sharp-pointed instrument, and penetrating, they are to be deemed hazardous, and the chance of death is increased when the blood-vessels or nerves of the

with half-digested food. There was an aperture with blackened edges, of the size of a shilling, an inch below the junction of the œsophagus, with the stomach on its posterior surface, and another corresponding aperture on the anterior surface of the stomach, also at the cardiac end, but lower than the aperture on the posterior surface. The liver and intestines were healthy and uninjured, and no important blood-vessel was wounded.

Mr. R. H. Semple, the reporter of the case, imagines that instant death "must have been caused by the sudden shock given to the nervous system by the passage of the bullet through the distended stomach. No other cause of death," he observes, "can be assigned, for no other viscus was wounded, nor was any important vessel ruptured." (*Lancet*, May 14, 1842.)

* See a case of this nature in the *Medico-Chirurgical Review*, vol. i. p. 103; also in *Philosophical Transactions*, vol. xix. p. 178.

† The remarkable case of Dr. Beaumont is of itself sufficient to show that life can be preserved after a severe and extensive wound of the stomach. I have met with an analogous case, which appears to have escaped notice, in the *Transactions of the Royal Irish Academy*. Dr. George Burrows mentions the case of a man wounded in the stomach with a blunt-pointed wooden instrument. He survived the effects twenty-seven years, but had always an opening, which he kept closed with a plug. On dissection, this opening was found. (*Medical Facts and Observations*, vol. v. p. 185.) Other cases of recovery from wounds have been related by Mr. Travers, in *North American Medical and Surgical Journal*, vol. ii. p. 199; by Mr. Breton, in *Transactions of the Medical and Physical Society of Calcutta*, vol. i. p. 59; by Mr. Scott, in *Medical Communications*, referred to by Sir A. Cooper; *Lectures*, vol. iii. p. 155; by Dr. Beatty, *Cyclopedia of Practical Medicine*, art. *Death from Wounds*, vol. iv. p. 556; by Dr. New, of Mississippi, *Western Journal Med. and Phys. Sciences*, vol. xi. p. 551. An individual was stabbed, and a protruding substance was removed, which proved to be a portion of the stomach. The parts were secured by a ligature, and the patient recovered in sixteen days.

Dr. John Watson has collected a number of cases of recovery, in *American Journal Med. Sciences*, N. S., vol. viii. p. 327.

part have been injured.* But a rupture or division of the coats of the stomach may also be effected by a severe contu-

* Dr. Andrew Duncan, Jr., in a clinical lecture at Edinburgh, (1830,) mentioned the following case, which may serve as a check to hasty opinions: A man died in the infirmary of rupture of the ascending aorta. Death was not, however, immediate, as he survived several hours in consequence of a clot acting as a partial valve. On dissection, the stomach was found distended with blood, and the bystanders were already engaged in conjectures as to the cause, when the removal of the fluid showed the perfect state of that organ; and it became evident that the blood must have been swallowed, according as it was discharged from the aneurism. (Lancet, N. S., vol. vi. p. 169.)

Trial of Charlotte Hamblin, alias Charlotte Ewing, for the murder of Andrew W. Ewing, at Mobile, State of Alabama, in November, 1842.

The deceased was an actor by profession, aged about twenty-five years, and of intemperate habits. On the night of the 25th of March, while playing his part at the theatre, he and his wife came off together from the stage, and while doing so, she asked him why he had not been home that day. He replied that it was none of her business, and at the same time struck her with his fist or hand, and knocked her against the scene. Ewing then left to go down stairs, and his wife followed him. In a very few minutes thereafter, two witnesses depose that they met her at the foot of the stairs, holding a weapon of some sort in her hand, exclaiming that she had killed him. Deceased was found lying across the threshold of the dressing-room, speechless, with two wounds in his right arm.

He was proved to have enjoyed good health for several years, and to have played parts which required great physical exertion. It was also stated that he frequently engaged in billiards and ninepins, and never complained of fatigue or difficulty of respiration. For the prosecution, Dr. Kelly deposed, that on being sent for, he found Ewing dead. There were two wounds upon the right arm, by which the basilar artery was cut in two places; these wounds were near the olecranon, and superficial upon the inner and lower side of the arm. There was another wound upon the left side of the body, between the false ribs and the iliac region, obliquely and upward. Dr. Kelly did not attend the dissection, but upon introducing a probe into the wound, he found that the dagger had penetrated at least two or three inches in the direction of the stomach and spleen. He could not say whether the deceased came to his death by the wounds received. He did not observe any arterial blood issuing from the wound.

For the defence, it was proved that Ewing was quite excited that evening, but not so as to interfere with his business; that after the wound had been inflicted, his wife exclaimed, "why have you struck me?" and repeatedly implored forgiveness. It would also seem that the dagger she wore was appropriate to the part which she was acting.

Dr. Levert examined the body, and at first supposed that the wounds were the cause of his death. The following appearances were observed: The abdomen was full and much distended; two slight wounds on the right

sion, or a blow on the part, without any external wound, surgically speaking, being present. Fabricius mentions the case of a man who was so dreadfully trodden under foot, that not only the stomach was burst, but there was a rupture of the diaphragm, and the food passed into the cavity of the thorax, and notwithstanding this, except some slight elevations of the epidermis in the form of vesicles, the integuments and abdominal muscles did not appear in the least injured.*

forearm, and a slight wound apparently on the left hypochondriac region. There was no hemorrhage from this wound, but upon moving its lips with the finger and thumb, a small quantity of dark-colored blood was seen to issue from it. On opening the abdomen, its whole cavity was found filled with blood, and which had evidently caused the distension noticed above. Dr. Levert's first impression was, that some important blood-vessel had been opened by the dagger with which he had been stabbed, but upon tracing the wound with great care, he soon ascertained that no vessel of any size had been touched. The dagger had entered the left hypochondriac region, just under the margin of the false ribs; its direction was a little upward and inward; it passed through the mesocolon, near to the gut, but without wounding it, and into the cavity of the stomach near its large extremity. It entered the cavity of the stomach without passing through its opposite side, and the wound was small, being made merely by the point of the instrument.

Dr. Levert remarks, that as there was no blood-vessel of sufficient importance injured in the track of the wound to account for the sudden death, or for the immense quantity of blood found in the abdominal cavity, he came to the conclusion that some cause, other than the wound with the dagger, must have produced the fatal result in so short a time. After sponging the blood from the abdomen, he discovered a large aneurismal tumor, which occupied and almost entirely filled the right iliac fossa. This aneurism had been ruptured at a point below and to the right of the duodenum. It was thus one of the descending aorta, and, from the large quantity of fibrinous matter which it contained, and the very attenuated condition of its parietes, of long standing. The witness hence came to the conclusion, that as the dagger had not passed near the aneurism, its rupture must have been caused by Ewing's high state of mental excitement, increased by the spirits which he had taken; and on the trial the testimony was to the above effect.

The jury, after an absence of about ten minutes, returned a verdict of not guilty.

I am indebted for the above facts to a newspaper account of the trial, and also to a communication from Dr. Levert to Professor Horner, both of which have been kindly forwarded to me by Dr. Hays. (*Am. Journ. Med. Sciences*, vol. v.)

* Mahon, vol. ii. p. 126. Rupture of the stomach from falls is rare. Devergie, however, relates a case in which the liver and aorta were torn, with

It will not appear surprising that sudden death should be the consequence of a blow on the epigastric region, when it is recollected that it is the seat of the solar plexus, and of the semi-lunar ganglion,* parts especially subservient to life, and also, that on dissection, no inflammation of the stomach and the other organs should in such a case be found.† Wounds

no less than from fifteen to twenty rents of the peritoneal coat of the stomach. The man had fallen from a second-story window. (Vol. ii. p. 46.)

* The effects of severe blows on the stomach, though well known to the vulgar, are hardly accounted for satisfactorily by the learned. A severe blow on the head, the seat of nervous contraction, often does not produce so violent an effect as a very slight blow over the semi-lunar ganglion. A case occurred in London, some years ago, where a man killed his comrade by giving him a pat on the pit of his stomach with his open hand. By the practice of the Scotch courts, if one man kills another by a blow on the stomach, the fact of his having done so is construed into malice, or what amounts to the same thing, *recklessness*, as it is termed. (DUNLOP.)

In a paper read before the British Association in 1837, Dr. Holland combated the idea that death in these cases was referable to an injury or impression made on the nervous system, and attributed the fatal result to the sudden propulsion of arterial blood, by means of the blow, into the left ventricle; this retrograde movement would so overpower the action of the parts as to cause sudden death. Several physicians, however, dissented from this opinion, and in particular Dr. Copland, who thought the cause of death a more general one, affecting many functions. It is to be regretted that we have so few dissections of persons thus suddenly killed. (London Athenæum, 1837, p. 685; Medico-Chirurgical Review, vol. xxxi. p. 576; London Med. Gazette, vol. xxi. p. 61.)

† "Inspectio et sectio aliquando nihil declarant," says Bohn, p. 114. So also sometimes with blows on the head; and a case of the latter description is cited by Smith (p. 250) from the History of the Royal Academy of Sciences of Paris: "A stout young criminal, condemned to be broken on the wheel, ran head foremost against the wall of his dungeon, with his hands behind him, and instantly fell dead. On opening the head, not the slightest appearance of injury was discoverable, either in the skull, brain, cerebellum, or spinal marrow, except a very minute separation in the squamous suture, which could not account for so sudden a death. The substance of the brain was unusually firm."

This point is so important, that I must be permitted to enlarge somewhat on it. "Slight injury to the stomach," says Sir Astley Cooper, "although it does not occasion any sensible organic change, will sometimes destroy life. A man recovering from fever, and walking in Fleet Street, quarreled with a woman; another female came up, and gave him a blow in the region of the stomach, which caused almost instantaneous death. Upon dissection, to discover the cause of his expiring so suddenly, no morbid change was perceptible. Again, a healthy laborer at the India House was attempting to lift a

of the intestines are less to be dreaded than those of the stomach, and the instances of recovery are infinitely more

heavy weight, when another laborer came up and said: 'Stand on one side, and let an abler man try;' at the same time, he gave the former a slight blow on the region of the stomach, when the poor fellow immediately dropped down and expired. On examination, there was not any mark of violence discovered." (Lectures, vol. i. p. 11.) Dr. Paris remarks that inflammation is out of the question in these cases, and therefore the slight redness of the stomach that is occasionally observed can alone be accounted for, by regarding it as the effect of the sudden cessation of the action of the heart (which has been found empty) producing an accumulation of blood in the extreme arterial branches. (Paris' Medical Jurisprudence, vol. ii. pp. 121, 174.)

Mr. Lambert, a respectable individual in New York, received a blow on the stomach from some rioters, immediately after coming from a supper party. He died almost immediately. On dissection, no mark of injury could be discovered, except some small red spots on the internal surface of the stomach, and there was no mark of external contusion. The brain was healthy. Dr. Post and the other witnesses concurred in believing that the blow was the cause of death, and not sudden fright. The prisoners were convicted of manslaughter. I have given the details of this case in the New York Medical and Physical Journal, vol. v. p. 427. [Dr. Joseph Parrish used to relate a case where two boys, 17 and 14 years old, were scuffling playfully, when the younger struck his companion on the epigastrium; instant death followed.—C. R. G.]

If we deem the above case of any weight, we can hardly justify the following decision, mentioned by Dr. Yeates: "Some years ago I was subpoenaed to give my opinion concerning the cause of death of a young woman, who had been severely kicked in the region of the stomach by a man. She was never well from that time to the day of her death, which happened several months after, and she frequently vomited blood. On opening the body after death, the internal coat of the stomach was found inflamed. During my examination, I was asked by the court whether the appearances would not appear without the ill treatment she had received; upon my affirmative answer, that such appearances sometimes occurred from constitutional causes, the judge directed the jury to acquit the prisoner, who was on his trial for murder." (Brande's Journal, N. S., vol. iii. p. 166.)

I subjoin to these, the remarks of a popular writer on physiology: That many of the organic functions are directly influenced by the nervous system, is a matter which does not admit of dispute. It is most remarkably manifested in the result of severe injury of the nervous centres, such as concussion of the brain, or of the solar plexus;* for this does not produce merely

* The author has no doubt that the occasional occurrence of death from blows on the epigastrium is to be attributed to this cause; in all the instances on record, the stomach has contained food at the time, and the effect of the blow would, therefore, have been propagated to the rest of the viscera and to the nerves distributed upon them. (Carpenter's Human Physiology, second edition, p. 358.)

numerous. But although all surgical works abound with these, we must not deem them destitute of danger, and if death follows after proper treatment, it is to be attributed to the injury.*

a suspension of the respiratory and other movements which minister to the organic functions, and thence a gradual stagnation of the latter, but a sudden and complete cessation of the whole train of action, which cannot be attributed to any other cause than a positive depressing influence of some kind propagated through the nervous system.

* Several cases of rupture of the intestines from violence are related. Dublin Hospital Reports, vol. iv. p. 349, by Mr. Speer, of the cæcum, from a fall in wrestling. Western Medical and Physical Journal, vol. i. p. 550, by Dr. Drake, of the jejunum, from a kick of a horse. Medico-Chirurgical Review, vol. xxiv. p. 142, two cases of rupture of the jejunum, one from a kick and the other from a cart passing over the abdomen, quoted from Bransby Cooper. Lancet, N. S., vol. xvii. p. 18, two cases by Mr. Ellis, of Dublin; rupture of the cæcum and rupture of the duodenum; in each from drays passing over the abdomen. American Journal of Med. Sciences, vol. xxi. p. 530, case by Dr. Annan, of laceration of the ileum, from the kick of a horse. Watson, on Homicide, pp. 78, 187, several cases. Sir David Dickson, at the British Association, in 1839; rupture of the duodenum. The patient had been wrestling, and was thrown with violence on the breech of a gun. London Med. Gazette, vol. xxv. p. 40, case of rupture of the ileum, from a kick, by Professor Samuel Cooper. Lancet, vol. xxv. p. 327, and by Dr. Williamson, in London Med. Gazette, vol. xxvi. p. 349. Rupture of jejunum, Lancet, N. S., vol. xxxi. p. 486. Rupture of duodenum, from a fall upon the bulwarks of a vessel; death in twenty-four hours. He ate a hearty dinner shortly after the accident, but was immediately thereafter taken violently ill. Lancet, March 23, 1844, p. 23. See also, Mr. Travers, in Medico-Chirurgical Transactions, vol. viii. p. 244, vol. xxiii. p. 8; Lancet, N. S., vol. xxii. pp. 92, 127, vol. xxiii. p. 547.

Symptoms of rupture of the bowels. "The symptoms following ruptured bowel are death-like, from the moment of the injury. They are quite unlike those of inflammation and of gangrene, and are indeed *sui generis*. The mind is clear but depressed, as if overwhelmed by the irreparable nature of the injury. The countenance is pale, and the features liny and drawn. The pulse is not immediately affected, but soon becomes quick, feeble, and irregular in its measure, intermitting, thready, and then no longer to be felt. The surface chills, but remains dry: there is a painful sense of dryness of the mouth and fauces, and frequent efforts to vomit. Pain, which commences at variable periods, but is never long delayed, is acute, unremitting, extending over the whole abdominal region, which becomes tense, and will not bear the slightest pressure. This produces great anxiety and restlessness, and frequent appeals for relief, and next for death. The peritoneal surface is reddened, but there is seldom any effusion of membranous or massive lymph agglutinating parts; only small deposits in tags and shreds roughening the

Wounds of the smaller intestines are more dangerous than those of the larger, not only because they perform more important functions, but are supplied with a greater number of nerves.* Wounds of the mesentery cannot be deemed mortal, unless some of the large blood-vessels of the organs or its principal glands be injured, and in these cases the danger arises from not being able to suppress the hemorrhage or to supply

surface, although the period of survival varies from twelve to six-and-thirty hours; the state of the canal perhaps determines this variation." (Benj. Travers, in *Medico-Chirurgical Transactions*, vol. xxiii. p. 8.)

Lydia Alder was tried in 1744, for the murder of her husband, whom she kicked in the groin, in consequence of which, having at the time an inguinal rupture, mortification came on, and he died. Verdict, manslaughter. (Paris and Fonblanque, vol. ii. p. 122.)

The following is a curious case, as well for its antiquity as the medical testimony presented. I apprehend, also, that at the present day, a conviction under the circumstances elicited could hardly take place:—

In 1678, in a drinking bout, Philip, Earl of Pembroke, struck Mr. Cony on the head, and afterwards kicked him. The next day he was seized with severe pains in the shoulders, and afterwards in the bowels, which continued until his death. Fainting fits occurred, but it was proved that he had been subject to them. There was no discoloration or bruises on the abdomen. He died on the sixth day, and after death a large black bruise was found on the breast; the body was swollen and discolored in various places, and a large quantity of extravasated blood was, on dissection, seen in the lower part of the abdomen.

Dr. Conquest deposed that Cony was very intemperate, and had drunk large quantities of beer during his illness. To these he attributed the gripes and vomiting, and the extravasation, although he states expressly that the bowels were not ruptured or bruised. The patient never complained of kicks or bruises. Dr. Lower, who saw him in consultation the day before he died, found no marks of fever either in his tongue, pulse, or water. The caul was withered and consumed; and Mr. Raven (I presume a surgeon) deposed that "it was well known to all physicians that in all natural deaths there must be extravasated blood in the lower belly."

Lord Pembroke was tried by his peers at Westminster Hall, and eighteen votes declared him not guilty, while forty pronounced him guilty of manslaughter. (Hargrave's *State Trials*, vol. ii. p. 461.)

* It would appear that the small intestines possess some of the irritable sympathy so conspicuous in the stomach, death being brought on by some unaccountable cause when they are only slightly injured. Foderé mentions a case where instant death was caused by a small prick in the small intestines, inflicted by the point of a butcher's knife, though there was neither a sufficient effusion of blood to account for such a result by its effects on the vascular system, nor a sufficient length of time for inflammation and its consequences to arise. (DUNLOP.)

the loss of the chyle. Wounds of the omentum are to be estimated like those of the mesentery; but it deserves remark, that a contusion is apt to induce inflammation and gangrene.* Wounds of the pancreas seldom occur, unless some other viscus be injured at the same time. If they should happen separately, the cause must have been an instrument entering at the back, and its wound cannot be considered as mortal unless some arterial or venous vessels have been injured. Wounds of the liver are generally mortal, and their fatality originates in some blood-vessel being injured, or in the consequences that ensue. Superficial injuries are, however, frequently healed†. Wounds of the gall-bladder are deemed absolutely

* If the omentum is protruded, and not speedily returned, it will, in common with all the other viscera of the abdomen, inflame and bring on gangrene; but the omentum is less obnoxious to inflammation than any other viscus. A strong illustration of this fact was related to me by a medical friend: A peon or messenger was brought to him in India, who had received a stab in the side three weeks before, through the wound of which the omentum had all this time protruded. On examination, he found that the viscus was adhering to the wound all round, and that inflammation had commenced without and been communicated to the interior of the cavity. Gangrene supervened, of which he died in a few days after. (DUNLOP.)

A hussar felt, as he said, "a crack in the breast," as his horse came to the ground, after taking a leap. Next day he complained of pain under the short ribs of the left side; he had cough, with bloody expectoration, and swelling, as well as pain of the left hypochondrium. The bowels were obstinately confined; the urine scanty and high colored; the pulse very small and rapid. Things went on from bad to worse, and the patient died early next morning. On examining the body, a rent in the omentum, to the left side, and one inch and a half long, together with five ounces of bloody effusion within the cavity of the abdomen, were discovered. The lungs appeared quite healthy. (Dr. Derner, in Casper's *Wochenschrift*; London Medical Gazette, vol. xxxiv. p. 128.)

† A case of recovery from a stab in the liver with a table-knife, is given by Dr. N. R. Smith, in *North American Archives*, vol. i. p. 385.

Prof. Dunglison quotes another from the *Journal of Dieffenbach*, etc., in which a boy fell on a knife, and a portion of the liver protruded. Without being aware of its nature, the surgeon in attendance cut it off with his scissors. No bad effects followed. (*American Medical Intelligencer*, vol. i. p. 191.)

A remarkable case of recovery from a dreadful wound of the liver, inflicted with a knife, is noticed in *Bulletin de l'Académie Royale de Médecine*, vol. x. p. 812. The case occurred to Dr. Roux, at St. Petersburg.

There is a remarkable case by Dr. Kilgour, (*Edinburgh Med. and Surgical*

mortal, as its fluid is stimulating to a high degree, and occasions inflammation and most violent pain.* Wounds of the various ducts are mortal. Those of the spleen are to be estimated like wounds of the liver; if deep and penetrating, death

Journal, vol. lv. p. 352,) in which the gall-bladder was found separated from the liver. The injury had been caused by a jumping on the belly. Death ensued in about thirty-six hours.

There is a case of spontaneous rupture of the liver, which proved suddenly fatal, during labor, related by Dr. King, in Dunglison's American Medical Intelligencer, vol. iv. p. 356. It is probable that the patient had been injured by violence on the part several months previous.

* There are but very few cases on record of wounds of the gall-bladder distinct from other injury. I have collected the following: Philosophical Transactions, vol. xxxvi. p. 341; an officer in whom the fundus was penetrated: he lived a week. Sir Astley Cooper's Lectures, vol. iii. p. 164; case by Mr. Edlin; wound with a bayonet. Death ensued in thirteen hours. Sabatier mentions another case, fatal on the third day.

Rupture of the gall-bladder by blows. Dr. Fletcher recently submitted to the Pathological Society of Birmingham a ruptured gall-bladder, taken from a patient, who, after fighting, had been suddenly taken ill, and, peritonitis supervening, had died the second day. Mr. Hodgson attributed the rupture to the unhealthy state of the bladder, and said that in a similar case a judicial inquiry was stopped on its being found by experiment that the gall-bladder of a sheep would not burst when struck with great force by a butcher's cleaver, as it lay on a block attached to the liver and intestines. In both cases of ruptured gall-bladders, the deceased (we should mention) showed no marks of external violence in any part of the region of the gall-bladder. (Medical Times.)

Watson, in *Journal de Médecine de Militaire*, relates a case of puncture with a bayonet. Death occurred in thirty-six hours. (Dr. Wm. Thomson on Diseases of the Liver.)

Dr. Reynell Coates, in the article *Wounds of the Abdomen*, in Hays' *Cyclopedia of Practical Medicine and Surgery*, however, refers to two cases of recovery, one by Paroisse and the other by Fryer. (Medico-Chirurgical Transactions, vol. iv. p. 330.) The first is the only *authentic* one. "I have never known a patient," says Hennen, "recover after a wound of the gall-bladder, except a previous adhesion had taken place to the parietes," and then quotes Paroisse's case. A case, he adds, I believe unique, is reported by Dr. Thomson, where nature had provided against the extravasation of bile from the substance of the liver into the cavity of the abdomen, by the means of newly-formed adhesions of considerable extent. (Military Surgery, p. 344.)

Professor Samuel Cooper, in some clinical remarks at the North London Hospital, (November, 1835,) observed that he knew of no case on record in which recovery had taken place after a wound of the gall-bladder. (London Medical and Surgical Journal, vol. viii. p. 509.)

will follow from hemorrhage. There are, however, many cases of recovery from injury to this organ.*

* A case is related by Mr. Ferguson, where a part of the spleen was removed with safety. (*Philosophical Transactions*, vol. xl. p. 425.) Two others are mentioned by Dr. Blundell, in his *Physiological Researches*; one on the authority of Mr. Cline, and the other on that of Dr. O'Brien. (*Medico-Chirurgical Review*, vol. vi. p. 404.) In 1801, Dr. Glover, of South Carolina, also removed a portion of the spleen in a person stabbed, and the patient recovered. (*American Journal Med. Sciences*, N. S., vol. i. p. 422.) M. Berthet, a similar case in *Forry's New York Journal of Medicine*, vol. iii. p. 404, quoted from the *London Times*.

Dr. Dunglison (*Physiology*, vol. ii. p. 249,) refers to cases of recovery from wounds, related by Adelon and Sir C. Bell; and there is a similar instance of cure by Dr. Powell, in the *American Journal of Medical Sciences*, vol. i. p. 481.

In the *India Journal of Medicine* it is stated that a native was gored by a buffalo, and through the wound there protruded a portion of the spleen. Six days after, Dr. Macdonald removed this with the knife, and the patient recovered. (*London Med. Gazette*, vol. xx. p. 285.)

Fatal cases are related by Dr. Abercrombie; by Dr. Ingalls, *Boston Medical and Surgical Journal*, vol. i. p. 296; by Dr. Tuthill, *London Medical and Surgical Journal*, vol. vi. p. 304; by Dr. Bright, *Guy's Hospital Reports*, vol. iii. p. 446; by Dr. West, *Philadelphia Medical Examiner*, vol. iii. p. 154. Four cases by Dr. Sotis, in *Edinburgh Med. and Surg. Journal*, vol. liv. p. 513; by Dr. Kilgour, *ibid.*, vol. lv. p. 355; by Dr. Welch, *Amer. Journal Med. Sciences*, N. S., vol. v. p. 503; and in *Amer. Journal Med. Sciences*, vol. vii. p. 549, from *Rust's Magazine*.

All these, except the last, occurred from falls or severe blows; in that, a woman, long afflicted with intermittent fever, was, in a quarrel with her husband, struck by him with a long elastic switch, and died in two hours. There was no mark of violence externally, though the blow was given over the region of the spleen; and, on dissection, that organ was seen ruptured. It, however, and the liver were so soft that a slight pressure was sufficient to tear them. The man was consequently acquitted.

There are also several fatal cases related by Mr. Heddle, in the *Transactions of the Medical and Physical Society of Bombay*, vol. i. p. 304. The violence used was very slight, but all had been or were suffering under fever, and it is of course probable that the diseased state of the spleen may have rendered it more delicate. In most there was no external mark of injury.

A robust man, about forty years old, was engaged in a scuffle with another of the same size, and received one blow from the fist of his opponent in the left hypochondriac region; the combatants then clenched each other, and so equal were their exertions for five or ten minutes that it seemed doubtful which would come off victor; at length, however, the strength of J. W. seemed suddenly to fail. He turned pale, staggered, and sunk helpless upon the ground, complaining of nausea, faintness, and pain in the left side. He

was carried, in a sinking condition, a short distance to a house, where he expired, in about fifteen minutes after the termination of the conflict.

On dissection, twenty-four hours after death, no marks of violence were observed on the exterior. The cavity of the pericardium contained about two ounces of effused serum. In other respects, the contents of the thorax appeared natural. But upon cutting through the abdominal parietes, exit was given to between two and three quarts of dark, partially coagulated blood. An extended incision brought into view the spleen, enlarged to about five times its natural dimensions, and so soft in texture as to be easily broken down under a slight pressure from a finger. Upon its posterior surface was a lacerated fissure of about five inches in length, extending deep into the centre of the organ. It was evidently from the divided blood-vessels of this torn structure that internal hemorrhage had taken place to such an extent as to cause immediate death.

The coroner's verdict was as follows: "Death from lacerated diseased spleen, caused by a blow, fall, or over-exertion while engaged in a scuffle with B. R." B. R. was tried for manslaughter, and acquitted by the circuit court. (Dr. Herrick, in *Illinois Medical Journal*.)

Spontaneous rupture of the spleen. 1. *Edinburgh Med. and Surg. Journal*, vol. liii. p. 522, by Dr. Noeckel (*Medizinische Zeitung*, May, 1839). Death followed in a few hours after a brief previous illness.

2. *Bulletin de l'Académie Royale de Médecine de Paris*, vol. i. p. 133, by Dr. Delaporte de Vamontier. A female. Death in twenty-four hours.

3. *American Journal Med. Sciences*, N. S., vol. iv. p. 369, case by John Neill, M. D. A seaman died suddenly and easily, but had been previously ill. Dr. Neill refers to the case of a soldier who fell down dead, and spleen found ruptured, mentioned in *Journal des Connaissances, Medico-Chirurgic.*, April, 1842.

Case of death from rupture of the splenic vein. By Dr. Milling. A. A., twenty-six years of age, of great muscular strength, laid a wager that he would perform a certain piece of work with a shovel or dung-fork, in the farm-yard, in the course of two hours. He had almost completed the work, and won the wager, when he began to complain of pains in the bowels. He drank several glasses of brandy, and went on with his labor; but the pain in the abdomen increased; he was seized with a violent shivering fit, and had to be carried to bed, where he fainted. He was ordered a dose of castor oil and an oily emulsion. In the evening he still complained of a feeling of chilliness, of pains in the belly, and a disposition to vomit. His belly was very much distended, and painful on pressure; pulse extremely small and contracted; countenance sunken, with the expression of deep suffering. He was bled, but syncope supervening, the vein had to be stopped. Twelve leeches to the belly and repeated clysters were prescribed, the patient not having yet had any opening from the bowels. These means proving ineffectual, he was put next morning into a warm bath, and felt himself relieved, but the distension of the belly went on increasing. He now became excessively anxious; he had long fits of shivering, cold extremities, clammy sweats, hiccough, and facies hippocratica. In the afternoon, having requested to have another warm bath, he was put into it, but within five minutes he was taken out dead.

It is a common circumstance in cases of sudden death from accidents, falls, etc., to find the spleen or liver lacerated; and this is, therefore to be deemed a fatal injury.* Wounds of

The body was extremely pale; the abdomen distended to bursting. As soon as the abdominal parietes were cut through, an interminal stream, as it appeared, of fluid blood flowed from the opening, so that the room immediately became inundated with it. All the blood having at length drained off, the viscera, liver, spleen, bowels, etc., presented themselves without a trace of inflammation. After a long search, Dr. M. at length discovered a rent, several lines in length, in the splenic vein, from which the fatal hemorrhage into the abdomen had taken place. (*Medizinische Zeitung*, No. 8, 1844; *London Med. Gazette*, vol. xxxv. p. 207.)

Rupture of an aneurism of the left gastro-epiploic artery. By Dr. Allé. A young woman, in the fifth month of her pregnancy, attended a ball with her admirer, where she danced till two o'clock in the morning. She was now seized with such violent pain of the abdomen that she had to be carried home. The medical attendant who was summoned to the patient found her cold, pulseless, and with all the symptoms of effusion of blood into the abdomen. She died very shortly afterwards. The post-mortem examination, which was performed by Dr. Allé, discovered the abdomen to be quite full of blood, partly fluid, partly coagulated. He imagined, in the first instance, that the hemorrhage probably proceeded from a rupture of the ovarium or tube, in consequence of extra-uterine conception, but careful examination showed everything in connection with the fetus in a healthy state. The source of the fatal hemorrhage was discovered to be the left gastro-epiploic artery, which was enlarged at one point into an aneurism, and had there given way. (*Lond. and Edin. Med. Journ. Med. Sci.*, March, 1843, from *Oester Med. Wochens.*, No. 51, 1842.)

Cases of spontaneous rupture of the spleen, preceded in all cases by disease:—

By Dr. Naechel, *Edinburgh Med. and Surg. Journal*. vol. liii. p. 522. By Dr. Allé, *London, Edinburgh, and Dublin Monthly Journal of Med. Sciences*, vol. iii. p. 244.

There is a monograph of cases of spontaneous rupture of the spleen, by Dr. Vigila, in *Archives Générales de Médecine*, December, 1843, and January, 1844.

He enumerates eight cases, all as a sequence of intermittent fever. Death occurred in from a few hours to six days.

* On the morning of the first of January of the present year, (1824,) three soldiers attempted to get out of Edinburgh Castle, to join the riot with which the new year is uniformly ushered in by the people of Scotland, but mistook their way in the dark, and precipitated themselves over the perpendicular side of the rock. They were found dead the next morning, and the livers of the whole of them were found, on dissection, to be lacerated. (DUNLOP.)

A rupture of both the liver and *pancreas*, originating from a blow on the ribs by the wheels of a stage-coach, is mentioned in the *Lancet*, vol. xii.

the kidneys have often been successfully treated; they are, however, dangerous, according to their depth and the effusion of urine (if any) into the abdomen.* So also with wounds of the ureters.

Wounds of the bladder would not seem to be even very dangerous if we look at the success which ordinarily attends

p. 384. A fatal case of rupture of the liver, from a fall from a wagon, and where death followed in fourteen hours, is given by Dr. J. Green, of Lowell, American Journal of Medical Sciences, vol. vi. p. 539. Another fatal case in fifty-two hours, from a wheel passing over the abdomen, is related in Midland Medical and Surgical Reporter, vol. ii. p. 76.

Mr. Watson also mentions several cases in which the liver was lacerated by violence. Death ensued almost immediately. (Watson on Homicide, p. 102.) Devergie, (vol. ii. p. 45,) remarks that, in rupture of the liver, the blood is partly fluid and partly coagulated.

I have met with two cases of *spontaneous rupture of the liver*, both of which proved suddenly fatal during the process of labor; by Dr. King, in Dunglison's Amer. Med. Intelligencer, vol. iv. p. 356; and Dr. Chandler, in Boston Med. and Surg. Journal, vol. xxxiii. p. 398. In the former case, it is supposed that there might have been a blow on the part some months previous; but in the latter there had only been a chronic inflammation of the organ for a year or more.

* A successful case of treating a severe wound of the kidney was related to me by my friend, Dr. Knox, of Edinburgh: A boy, at the Cape of Good Hope, received a deep wound in the left kidney from a butcher's knife, which was thrown at him. He was brought to Dr. Knox, who caused him to be placed and retained in such a position that the wound should be the most depending part of the body. In a short time he made a complete recovery. There are instances of death arising from slight blows on the kidney, where it contains a calculus. A gentleman in India was tried for the murder of his servant, whom he killed by a blow on the loins; on its being proved that the kidney contained a calculus, the ragged points of which had punctured the blood-vessels, he was acquitted. (DUNLOP.)

A case, which the narrator supposes to have been a wound of the kidney, and which was cured, is given by Dr. Borthwick. (Annals of Medicine, vol. iv. p. 466.) Hennen also relates of an officer who was wounded by a musket-ball in that region, and who suffered long, but finally passed with his urine a piece of cloth. (Military Surgery, p. 330.) He adds, however, that the cases on record of recoveries from wounds of the kidney are not numerous.

Fatal cases of the rupture of the kidney from blows, are mentioned by Mr. Laidlaw, in London Medical and Physical Journal; American Journal of Medical Sciences, vol. xi. p. 199, and by Bransby Cooper, Medico-Chirurgical Review, vol. xxiv. p. 144; by Dr. Kirkbride, of Philadelphia, American Journ. of Med. Sciences, vol. xv. p. 359; Lancet, N. S., vol. xxiv. p. 935. A case that occurred to Mr. Vincent in St. Bartholomew's Hospital. (London Med. Gazette, vol. xxxiii. p. 253.)

the operation of lithotomy.* They may, however, prove hazardous from the effusion of its contents or the injury of a blood-vessel.† Wounds of the neck and sphincters of the

* [In the ordinary operations for lithotomy the bladder is not wounded; the incisions for entering it do not, or should not, extend beyond the limits of the prostate gland. In the high operation, which is occasionally performed, the bladder is cut, but in such a way as to protect the bowels from the infiltration of urine; for this is the circumstance following wounds of the bladder which renders them particularly dangerous.—J. W.]

† Mr. T. E. Rawson mentions a fatal case in thirty-six hours from ulceration and perforation of the bladder. (*Lancet*, December 2, 1843, vol. xxxiii. p. 299.)

Solutions of continuity in the bladder, from punctured and gunshot wounds, are almost invariably fatal by the supervention of peritonitis, but a considerable period sometimes elapses before the symptoms set in. The most common form of rupture of the bladder, however, is from external violence, when the viscus is distended with urine. Such an accident is not necessarily fatal; but as it almost always occurs where the serous membrane covers it, the issue is generally unfavorable. Mr. Hird related an interesting case at the Medical Society of London, which is quoted by Mr. Coulson, to show that the patient may walk several miles after complete rupture, and for a time exhibit no symptom which attracts more than ordinary attention. Cases of spontaneous rupture from over-distention are rather examples of sloughing than of anything else, the openings being generally numerous and small, and the texture of the bladder softened. Rupture during labor may occur from manual violence, or from the pressure of the child's head, and is, on the whole, not a very uncommon accident; such cases ranking among the most distressing conditions with which we have to do. (*British and Foreign Medico-Chirurg. Review*, July, 1852.)

Fatal cases of rupture of the bladder from external violence are given by Cloquet, *North American Medical and Surgical Journal*, vol. v. p. 231; by Dewar, *Edinburgh Medical and Surgical Journal*, vol. xxxi. p. 86. (In his remarks on this case, Dr. Craigie refers to all the instances then on record;) by Dupuytren, *American Journal Med. Sciences*, vol. xii. p. 535. This occurred at the *Hôtel-Dieu*, and although pronounced by Dupuytren to be a ruptured bladder, was doing well, when, from some imprudence in eating, peritonitis came on, and the patient died on the seventeenth day. On dissection, marks of adhesion were seen between the intestines and bladder. Additional cases of fatality are related by Mr. Ellis—one from a blow from a watchman's pole, and another from a horse rearing and falling on its rider. (*Lancet*, N. S., vol. xvii. p. 20.) By Professor Syme, of a female falling forward on the edge of a tub. Inability to pass her urine and peritonitis ensued, and death followed in a week. On dissection, a small rupture was found at the fundus of the bladder; *Edinburgh Med. and Surg. Journal*, vol. xlv. p. 269; at the *Middlesex Hospital*, London, July, 1837. (*British Annals of Medicine*, vol. ii. p. 80.) By Mr. Coulson, in his *Essay on Diseases*

bladder are apt to leave incontinence of urine; and when this does occur it should be stated in the report.* Wounds of the uterus are dangerous in proportion to the hemorrhage that follows and the symptoms that supervene. If that organ be impregnated, the danger of course is increased.†

of the Bladder, reprinted in *Dunglison's American Library*; by Mr. Lawrence, *London Med. Gazette*, vol. xxiii. p. 661; by Mr. Hiley, in which the patient survived four days, and during most of that time had the power of voiding his urine, *Lancet*, May 14, 1842, p. 223; by Prof. Syme, London, Edinburgh, and Dublin Monthly Med. Journal, vol. iii. p. 498. Cases by Messrs. R. W. Oldfield and R. W. Smith, in *Lancet*, April 6 and 13, 1844. A case at the London Hospital, where the patient survived three days and seventeen hours. (*Lancet*, June 15, 1844, p. 387.)

"Wounds of the bladder within the peritoneal sac, or even behind the reflection of the pelvic fascia, are almost inevitably mortal." (LISTON.)

"When the bladder is penetrated in any part of its parietes, covered with peritoneum, it is usually mortal." (LARREY.)

* Since 1835, I have met with no less than three cases, in which the question before the legal tribunal was, whether rupture had been caused by blows on the region of the bladder. I will briefly state them: Professor Syme mentions that, at a convivial party, blows and wrestling passed between two persons. One of them walked home more than a mile, and in crossing his threshold, fell forward on his abdomen. When lifted up, he felt great pain, and was unable to help himself. He died in two days, and rupture of the bladder was found. Professor Syme was consulted, and he gave it as his opinion, that the injury resulted from the *fall*, and that the individual could not have walked home if the rupture had happened from the *blow*. (*Edinburgh Med. and Surgical Journal*, vol. xlv. p. 269.) Another case occurred in France. Two persons were fighting, and one kicked the other in the hypogastric region. The injured man died in seven days. On dissection, every part was healthy except the abdomen. There was a laceration of the bladder, and its mucous membrane was highly inflamed. Adhesion and false membranes also occurred among the intestines, with extravasated fluid. The examiners, Drs. Guersent and Dennis, testified that death was owing to the rupture caused by the kick. (*Annales d'Hygiène*, vol. xv. p. 206.) A very similar case was tried before Lord Denman, at Lancaster, in March, 1836. Here death occurred on the fifth day, and the main defence set up was that the rupture might have been occasioned by dissection. Lord Denman remarked that if so, it was very extraordinary it should happen immediately after a violent kick on the part. The prisoner was found guilty. (*London Medical Gazette*, vol. xviii. p. 61.)

† "A medical friend of mine related to me the following case: When in Ceylon, he was called to see the wife of a sergeant, who had received a stab in the side with a knife, wounding the uterus, she being then in the eighth month of her pregnancy; and on asking her how she got hurt, she said that in carrying out some knives which she had been cleaning, her foot

slipped, and she let them fall and fell on the top of them, when one of them entered her side and produced the wound, of which she soon afterwards died. She had, however, told some of her companions, the women of the regiment, that it was her husband who had inflicted the wound; and as it was known that they did not live on the happiest terms, this excited suspicion, and the husband was ordered for trial. On dissection, it appeared that the knife had entered from above and gone downward, which could not well have happened had she been wounded in the manner she described to the surgeon. From circumstantial proof it was like to have gone hard with the prisoner, but he was let off on the evidence of one of the surgeons, who, when interrogated on the subject, said *that the wound was not necessarily mortal*. I have since learned the private history of the jury in this case; it is as follows: The Ceylon jury consisted of thirteen; of these, one declined voting, six were of the opinion that it was manslaughter, and six wished to bring it in murder. In this state they sat for some hours, till at last, one of those who was for the severe sentence relented, and a verdict of manslaughter was given." (DUNLOP.)

The following case is highly interesting, and its doubtful points deserve a more minute investigation: At a meeting of the London Medical Society, in February, 1836, Dr. Blicke mentioned that a female was taken in labor at 7 A.M. From 11 A.M. to half past two, the pains were very severe, but after that they had ceased. Dr. Blicke was called in the next day, and suspected rupture of the uterus. The case was left to nature, and the female sunk and died the next morning at two o'clock. In fifteen hours after, the body was examined. A bruise was distinctly traced through the parietes of the abdomen, and there was a slight opacity in the corresponding portion of the peritoneum, like the effect of previous inflammation. The uterus was very healthy, and *most firmly contracted*. It was ruptured from the cervix to the fundus.

At the first visit of Dr. Blicke, she told him that she was sure he could not save her, as she had been some time previous violently beaten by her husband, who had knelt on her abdomen, and she had never been well since. On the trial, Dr. Blicke gave it as his opinion that the injury had produced some partial lesion of the uterus: and that when that organ came to be in action during labor, it was unable to overcome the resistance of its contents, and was ruptured. A distinguished accoucheur was sent for, who gave it as his opinion that an injury inflicted on a pregnant woman, if it did not produce labor at the time, would not, six weeks afterwards, have anything to do with producing rupture of the uterus.

Mr. Kingdon remarked that he had no doubt that an undue attachment of the placenta, the result of inflammation in consequence of a blow, did take place, and destroyed the woman by hemorrhage at the time of labor. He related a case in point, in which the injury had been some time before received. (London Med. and Surgical Journal, vol. ix. p. 122.)

A case in which the patient survived the forcible removal of the uterus and its appendages after delivery, by the midwife, is related by Drs. Drane and Ballard, in Western Journal of Medicine and Surgery, vol. i. p. 478, and vol. ii. p. 157. There is another case of recovery, in Medico-Chirurgical Review, vol. xxviii. p. 482.

Several cases have been recently published of sudden and fatal hemorrhage into the cavity of the abdomen from the rupture of extra-uterine conceptions.*

In all these instances of wounds of the abdomen the danger is aggravated from extravasation; and this again is increased according to the nature of the fluid, which may be either blood, chyle, bile, fecal matter, or urine. An extravasation of blood is often within the power of the surgeon, but its consequences are, however, always to be dreaded. The other evacuations can scarcely, if ever, except in the case of the urine, be remedied by means of operations, and are hence very generally mortal.†

Wounds of the testicles are dangerous, particularly if they have been contused or injured by a sharp-pointed instrument. Their division, indeed, by a cutting instrument may be mortal, unless the subsequent hemorrhage be speedily prevented.‡

* Mr. Watson refers to several in his Treatise on Homicide, p. 103.

† "The complete effusion of bile, urine, and feculent matter, prove uniformly fatal, by their quality inducing a destructive inflammation." (Travers on Injuries of the Intestines, London edition, p. 72.) It has been proposed to avert the evils arising from these fluids remaining in the cavities, by removing them by puncturing, as is practiced in dropsical cases; and this I could suppose may be practicable in some cases, as where any very fluid liquid is to be got out; water, for instance, or serum, may be drawn off by puncturing at the lower part of a cavity where it may be lodged; but in other instances there would be little to hope for from the operation. Bile, urine, feces, and chyle, are highly irritating in their nature; and though, which is very doubtful, we are enabled to remove them from the cavity, we should find it impossible to command the wounded gall-bladder, biliary duct, kidney, ureter, or intestine, from which they proceed; so that the operation would only be inflicting pain without any rational hope of success, as they would be renewed as fast as they were removed; and as for blood, unless the puncture was made instantly, it would most likely coagulate, and in that form it would be impossible to get it through a small punctured hole; making a large incision is, of course, quite out of the question; and blood, if likely to find its way out at all, will do so through the hole through which the wound was inflicted. (DUNLOP.)

‡ *Death from violence to the testicles.* It appears that among a certain class of people of Germany, in resorting to blows, it is customary to endeavor to grasp and squeeze these organs, and prize-fighters are accordingly accustomed to cover and protect these organs. A few years ago, at or near Peitz, a young man who had interposed between two combatants, was observed to fall to the ground, uttering a loud cry, and after having been seized with violent convul-

The same remark applies to wounds of the penis; but in other respects, injuries of this organ are not to be deemed dangerous. Wounds of the female organs are often highly dangerous, from the profuse hemorrhage that ensues.*

The extent and variety of injuries that the abdomen and the viscera contained in it may receive, call for all the skill of the surgeon, and his judgment will be frequently exercised in deciding on the fatality or danger of wounds of this part of the system.

Wounds of the extremities are to be decided upon according to their nature; but the majority of them are not dangerous. Of simple wounds I have already spoken, and it is sufficient to add that when the integuments and first layer of muscular fibres only are wounded, they will heal without difficulty. The presence of syphilis and scrofula may, however, cause their dege-

sions, in a few minutes died. Every attempt to restore animation failed, and the cause of death remained in obscurity until the next day, when, on dissection, the scrotum and penis were seen strongly injected and much swollen, and on opening the abdomen, about four ounces of blood were found behind the peritoneum, upon the psoas muscle of either side, at the place where the spermatic cord passes through the abdominal ring and the vas deferens leaves the spermatic vessels. At this point, the spermatic artery and vein were, if not torn, at least so distended and attenuated that their coats appeared quite porous and cribriform, and had evidently given egress to the blood, which was discovered extravasated. (Lancet, March 11, 1843.)

* Two interesting cases are related by Mr. Watson, of Edinburgh. (Edinburgh Medical and Surgical Journal, vol. xxxvi. p. 85.) In both there had been an incision into the labia pudendi, evidently with a cutting instrument, and either a razor or a knife. Death followed in each after a few hours. The murderer was convicted in one case, and in the other only escaped because the medical witness stated that it was *possible*, but *very improbable*, that the wound might have been occasioned by falling on glass or a sharp body. The wound was not lacerated, nor penetrating, but a clean incision; and it is evident in order to inflict it as supposed in the defence, that "the female must have sat down upon a piece of a glass standing erect, and her clothes must have been out of the way, as they were not cut." All this, too, must have happened on a pair of stairs.

It is remarkable, that in both cases, the murderers were the first to call medical aid, probably supposing that the hemorrhage would be attributed to flooding.

In his work, Mr. Watson adds two additional (fatal) cases. In both, the murderers were convicted and executed.

nerating into ulcers: and it must also be noticed that wounds of the extremities, in which the muscular fibres are transversely divided, will take a long time to heal. Contusion also may increase the inflammation or induce suppuration. Wounds of tendons are generally tedious, and when cured are often followed by a loss of substance, and a want of mobility in the parts. Compound fractures are sometimes hazardous, [and those of the thigh particularly so,] as also fractures near articulations, or of parts surrounded by large masses of muscles. Comminuted fractures are extremely tedious in their cure. Finally, fractures in young persons, and in those who are in good health, are more readily healed than in old persons, valetudinarians, and pregnant women. Wounds complicated with dislocations sometimes induce alarming symptoms, as also those in which an important nerve is divided. The prognosis, however, is favorable, unless serious symptoms supervene on the disease, and which are referable to it. Wounds of the arteries and veins are not considered dangerous by modern surgeons, if timely aid be afforded, [and the vessel be healthy and easily accessible;] but under other circumstances, a wound of a large blood-vessel may prove fatal. The system may be injured, or so much blood may have been lost, as to render assistance of little value.* Mr. Watson states that the loss of from five to eight pounds of blood is required to prove fatal in cases of adults. This, however, is not invariable, as some individuals cannot bear the loss of blood so well as others. It is extremely rare that wounds of the veins prove dangerous, except the brachial or femoral ones be wounded near the trunk.† Wounds of the articulations are generally to be dreaded, and the appre-

* The following case may also occur: "J. Denton was indicted in September, 1813, at the Old Bailey, for the murder of C. Denton. He had struck her with a knife, and she lived a month thereafter. The medical testimony stated that the wound nearly divided the arteries of the arm—it *mortified*, and she died in consequence. He was condemned and executed." (Edinburgh Annual Register, vol. vi. part 2, p. 121.)

† [Wounded varicose veins are always dangerous, and often fatal. I have known a ruptured varicose vein in the leg give rise to fatal hemorrhage. A wound in any of the large veins at the root of the neck is particularly dangerous.—J. W.]

hension is increased when they are complicated, as, for example, with contusion, hemorrhage, or fracture.*

* "There was a very interesting case came on before the judiciary court, during the autumn circuit, at Glasgow, in the year 1822. A man of the name of Pace, gamekeeper to Lord Blantyre, was tried for the murder of a poacher, whom he shot so severely in the left arm that it was found necessary to amputate it above the elbow. The man died of erysipelas phlegmonoides in the right leg; and the question on the trial was, whether the erysipelas was brought on by the wound or not. Upon this question the medical men differed totally. Mr. John Burns, the most eminent surgeon in Glasgow, gave it as his opinion that the debility caused by the wound brought on the disease of which he died. Dr. John Thomson, of Edinburgh, was of opinion that it was brought on long before he received the wound. It appeared in evidence that the poacher had been out in the exercise of his vocation for two nights, and had slept without shelter; that during that time he had eaten but little: and, above all, that he had a foul ulcer on his leg, the absorption from which undoubtedly laid the foundation of the disease before the injury was received. Under all these circumstances, what could have been the best mode of treatment in such a case, supposing he had received no wound at all? Undoubtedly, the very treatment he did receive in consequence of it—copious bleeding, light diet, being kept quiet and still; and the counter-irritation of the amputation, so far from increasing the inflammation which was going on in the groin, must have acted like a blister, or a seton, in repressing and counteracting it. This appears to me to be the rational view of the case, and in this view the jury saw it, for the prisoner was acquitted.

"There are some wounds more apt to produce serious effects in different parts of the body than others. Thus, a cut in the adductor-muscle of the thumb (that muscle which lies in the palm of the hand) more frequently brings on lock-jaw than an injury of equal extent anywhere else. While on the subject of lock-jaw, which must be looked upon as a spasmodic action of the muscular system generally, rather than a mere contraction of the temporal muscle only, which is merely a symptom of the disease, I may remark that a predisposition to this is brought on by particular climates, especially within the tropics, which could not, *à priori*, have been expected. When the expedition sailed from England to Buenos Ayres, in 1807, in the hospitals of most of the regiments employed there, lock-jaw was a very frequent effect of a wound in any part of the body. The same troops went to the Cape of Good Hope, where no such effects ever appeared at all. The 89th regiment went from that to Ceylon, where no lock-jaw ever followed a wound; and thence to Java, where it was the cause of death in two-thirds of the wounds. Here we have four hot climates, two of them notoriously unfavorable to Europeans, and two of them the healthiest that we know of, and yet the tetanus took place in South America and Java, and was not to be found in Ceylon or the Cape; the former quite as unhealthy generally as Java can possibly be.

"A fall from a height, or a sudden blow, may produce laceration of a

Finally, the prognostic from wounds from fire-arms is, in all cases, more serious than that of wounds from cutting instruments.* [The crushing wounds, so common of late from rail-

joint; and whenever this takes place and terminates fatally, such an event must be attributed to bad habit of the body, or the pre-existence of some irritating disease; in which case, should it be made the subject of judicial inquiry, it is the duty of both the lawyer and surgeon to make minute investigation into the patient's previous health and habits. It is seldom, however, that it comes under the investigation of a criminal court, at least in so far as its causing death; but in civil cases it is often tried, as in the upsetting of coaches, etc. There was a case of this kind recorded some time ago, in the newspapers, where the plaintiff, a gentleman who had been upset in a coach, recovered £800 damages against the defendant, a surgeon, for unskillful treatment of a dislocation of the shoulder-joint, by which the patient was partially deprived of the use of his right arm. In all similar cases, almost a similar verdict would be just, for though there may be exceptions, yet, generally speaking, permanent lameness after a luxation (unless, from disease of the bone, ankylosis have taken place after it is put in its proper position,) may be fairly attributed to mismanagement on the part of the surgeon." (DUNLOP.)

* It must not be forgotten that fire-arms, loaded with powder only, may inflict dangerous, and even mortal wounds. In answer to the question proposed to him in writing, what are the effects produced by a fire-lock charged with powder only? Dupuytren replied, that he knew a case in which a man in a quarrel was shot with such a weapon, the muzzle being close to his abdomen. His clothes and the parietes of the abdomen were lacerated, the wound penetrated the interior, and the man fell dead. He was examined, and Dupuytren was called in to decide what the piece had been charged with; whether shot, ball, or powder only. There was nothing found but the wadding. It often happens, he observes, that persons determined to commit suicide, forget, in their bewildered state, to put the ball into the pistol; and frequently, wretches who wish to shock their friends with their calamity, discharge into their mouths pistols charged only with powder; but the effects are dreadful. The wadding traverses the palatine vault, and the sudden expansion of air from the explosion lacerates the velum, and the lips and cheeks are torn in a radiated manner, in consequence of the excessive distension. Sometimes the lower jaw is fractured. (London Medical Gazette, vol. vii. p. 7.)

It is probable that the case of Dr. Elliot, tried at the Old Bailey in 1787, for shooting at Miss Boydell, was of this description. He fired a pistol when very near her, as she was walking. Parts of her clothes were burnt, and a surgeon swore that she had two contusions below the shoulder-blade, which corresponded with the mark on the gown. The jury found him guilty of shooting, but *they did not find that there was ball*. On this he was acquitted.

There is another point connected with this subject, which deserves further inquiry. It is the nature of burns caused by the explosion of gunpowder.

road accidents, are no less serious than those from fire-arms, and the extent of disorganization effected by them is always greater than would at first view appear probable.—J. W.]

Mr. Lonsdale has suggested that the presence of particles of the powder in an *exploded* state under the skin (as is often seen) is owing to the discharge from some fire-arm. He has repeatedly noticed severe injuries from the explosion of gunpowder lying free, but in no one instance of this were any particles left in the skin. May not the resistance offered to its expansion in the other case be the cause? (London Med. Gazette, vol. xi. p. 696.)

Burns from Gunpowder.—"In burns from gunpowder, it is to be observed that from the momentary application of the cause the injury is often of a superficial kind, unless in those cases where from the close contact, or large quantity of the powder, or from the accidental combustion of the patient's clothing, the parts become extensively and deeply involved. In many of the injuries originating from explosions of gunpowder, the hands and face are more particularly affected, and here the structure of the parts, as well as the nature of the accident, contribute to limit the number and extent of the vesications; the surface is blackened, the eyelashes, eyebrows, whiskers and whatever hairs may be contiguous to the affected part, are singed or entirely destroyed; grains of gunpowder are found lodged in the skin, some of them partially and others completely buried in it. When this has taken place, an indelible mark remains after the cure, not, as some have supposed, from each distinct granule of the powder remaining entire and inclosed in a minute capsule, but rather, I believe, from the granules being decomposed and partially discharged or absorbed, while the carbonaceous or coloring matter remains in the skin, as in those letters or emblematic figures which we often see artificially printed on the arms of soldiers and seamen, by pricking out the figure with a needle, and inserting a little gunpowder into the skin: a mode of marking deserters which is enjoined by the articles of war." (Sir George Ballingall's Outlines of Military Surgery.)

Wounds from fire-arms.—The prevailing opinion, sanctioned by some of the greatest names in surgery, is, that the entrance wound produced by a ball is always smaller than the exit one. Professor Malle, however, after numerous experiments on the dead body, found that directly the opposite occurred. He was inclined to explain this from the absence of vitality, and possibly also the position of the body. But not long after, a friend of his was wounded in a duel, and the apertures corresponded in size with those obtained in his experiments. Since that he has repeatedly observed the same result in the living subject. He, however, confirms the common statement as to the appearance of the respective wounds. The entrance one is rounded and depressed, while the other has ragged and everted edges.

He mentions the following curious instance of the deviation of a bullet. In July, 1828, two students of medicine fought a duel at Strasburg, at fifteen paces. One of them fell apparently dead. Dr. M. ran to him, and found him, though pale, already smiling. The ball had struck the larynx obliquely, passed completely round the neck, and was now to be distinctly

Such are, in as short a space as possible, the various prognostics of the numerous wounds (in a medico-legal sense) to which the body is liable.* But I must again remark in this place, that these or similar rules are not to be taken as infallible guides. It is only to aid the examiner in pronouncing an opinion that they deserve any attention, and he should rely principally on the circumstances of the case that is immediately before him. "It has indeed been argued that it is not enough to say that the person died of the wound, but that the wound must be characterized as mortal, thus taking advantage of the systematic arrangement in books on surgery, and deducing the conclusion, that when a man dies of a wound that is not there arranged as mortal, it must have originated from bad treatment, or misconduct, or irregularity on the part of the patient.† But the insufficiency of these divisions has been

seen on the opposite side of the larynx, from which it was readily removed by an incision.

Another interesting fact connected with this subject, is the occasional preservation of all the faculties, after dangerous wounds of the head. In 1833, a young man determined to destroy himself, and for this purpose fired a pistol at the internal angle of the left eye. Surgeons were immediately summoned, but the minuteness of the wound, and the calmness of the suicide, induced them to hope that it had been intercepted in some part of the bony orbit. A probe, however, passed deep into the brain. He was bled largely, and survived forty-one days, preserving perfect to the last his muscular, organic, and intellectual functions. After death the ball was found in the fourth ventricle.

An officer, related to the author, received a ball in his head at the battle of Wagram. He fell from his horse, but immediately recovered his senses, and was cured in about three months. After having served at the battle of Waterloo, he retired to his family and passed a happy old age, although menaced occasionally with attacks of inflammation of the brain. The ball was found, after his decease, in the left lobe of the cerebellum. "*Les fonctions génitales étaient restées pendant long temps fort actives, mais il vrai de dire aussi qu'elles avaient toujours été très puissantes.*" (*Annales d'Hygiène*, April, 1840.)

* The authorities on which this section is founded are Bohn, Foderé, and Mahon. The last two are in many respects a copy of the former. I have also consulted Samuel Cooper's Surgical works, Dorsey's Surgery, Charles Bell's Operative Surgery, Sir Astley Cooper's Lectures, Larrey's Memoirs, and Hennen's Military Surgery, together with Metzger and Belloc, and the dissertations in Schlegel.

† Lawyers are very apt to push the question as to the mortality of wounds to a considerable length, and by this means often embarrass the medical

often proved. Thus, "in a case of one John Shaw, at the Scotch bar, three physicians and two surgeons swore that by the rules of their prognostics the wounds received by James Houston were mortal; whereas Houston was alive, and the plaintiff in the very cause in which these gentlemen gave this testimony."^{*}

When a surgeon is called on to examine a wound, the effects of which may become the subject of criminal trial,† he should ascertain—first, whether it has been already dressed, or if some surgeon has not been attending to it; and second, whether

witness. I recommend the answer of the surgeon, who deposed on the trial of Count Koningsmark for the murder of Mr. Thynne, to the notice of the latter. Mr. Thynne was shot with a blunderbuss, and Mr. Hobbs, the surgeon, swore that he had examined the body after death—that four bullets had entered it; "that they tore his guts and wounded his liver, stomach, and his gall; wounded his great guts and his small guts, broke one of his ribs, and wounded his great bone below."

Sir Francis Withens. Did he die of those wounds?

Mr. Hobbs. Yes, he did die of those wounds.

Mr. Williams. Did you apprehend them all mortal, or any, or which of them?

Mr. Hobbs. *I believe there never was a wound, but it might prove mortal.* (Hargrave's State Trials, vol. iii. p. 473.)

^{*} Edinburgh Medical and Surgical Journal, vol. i. p. 339.

† I mention the following case, as it may be important for the surgeon to be aware of the doctrine contained in it. In the case on the King v. Salisbury, the prisoner was committed to Newgate for stabbing a gentleman with a knife, so that his life was despaired of. She moved that a physician and surgeon of her own nominating might be permitted to be present at the dressing of his wound, so as to be able to satisfy the court that he was out of danger, in order that they might bail her. *Sed per curiam.* There never was a motion of this nature, especially so early as this. The course is, for the friends of the party injured to lay his conditions before the court, when they oppose the bailing; if they do not do it, we may order such an attendance for our own satisfaction, but at present the defendant has no right to demand it. (1 Strange's Reports, p. 547.)

In the Commonwealth v. Trask, the court said: "If a person be imprisoned for dangerously wounding another, who happens to be in a languishing condition, the court will order that the offender be kept in prison until it shall appear the wound be mortal." (Massachusetts Reports, vol. xv. p. 277.)

On the other hand, I may be permitted to advise magistrates not to grant warrants for committing a man to jail on the mere oath of the injured person. The attending surgeon should certify to the imminence of the danger. Mr. Dease (p. 105) mentions some deplorable cases, from inattention to this.

the situation of the wounded person allows of an examination. Both of these are important, as much may depend on the skill and care with which the first dressing has been made: and again, should an examination take place while the patient is in a feeble state, and death follow during it, popular opinion will certainly attach great blame to the surgeon. The juridical examination of a wounded person must also be deferred in some cases, where the point or part of an instrument remains in the wound. Here a consultation is frequently required to determine on the propriety of its removal, and the question has often arisen, whether the death of the patient will not be hastened by immediately withdrawing it.

Let us, however, suppose the wounded person to be in a fit situation for the surgical and judicial examination. It is then necessary, before proceeding to it, to ascertain the nature and shape of the instrument by which the injury was inflicted.

In general, there is but little difficulty on this point. But it has been observed by Dupuytren, and confirmed by the experiments of Filhos, that a weapon perfectly cylindrical and pointed, will produce wounds with distinct angles.* Wounds also from perforating instruments, unless examined immediately, are smaller than the arm used. By the violence inflicted, the muscular fibres have been pushed aside, and they gradually return to their natural state as soon as the weapon is removed. Cutting instruments, on the other hand, produce a larger wound than the arm used, accompanied with effusion of blood and separation of the edges. There will, however, be a variety also in this, depending on the position of a limb at the time and the direction of the wound, whether parallel or transverse to the muscular fibres.

Sanson has given a case in which several wounds were inflicted with a blunt foil, (that is, with four angles,) yet three out of four of them were triangular. In another instance, he was called to state whether he thought that the end of a sharp foil could have produced seven oval wounds found on the body

* Devergie, vol. ii. pp. 15, 182. It appears, however, from the more recent experiments of Jaumes and Delmas, that the shape of the wound will be round, in parts having much fat.

of a young woman who had been assassinated. In the presence of the judges, and on the corpse of the murdered female, he made wounds with the identical instrument precisely similar to those inflicted during life.*

Another remarkable example is given by Ollivier (D'Angers :) A robber was shot, at the moment of his scaling a wall, by a person about fifteen paces distant. He fell dead without uttering a word. Two of the shot were found to have traversed the aorta at its base, and the wounds thus made had exactly the form of *linear incisions* with acute angles, precisely resembling those which might be produced by a sharp-cutting instrument. The instantaneous death was found to be owing to the pouring of the blood into the pericardium.†

Inquiry should also be made as to the relative situation of the parties at the moment of the wound; their respective stature and position. The examiner cannot be too minute, and he should be cautious in not making any observations on the nature of the wound before he has fully satisfied his own mind, lest they may hereafter be used to the disadvantage of his evidence. The form, length, breadth, depth, and direction of the injury, together with all the other circumstances already mentioned, should be noticed, and a detailed summary of the whole should then be drawn up in the form of a report. I must, however, caution concerning the impropriety, and indeed inutility, of declaring any wound, concerning which there can be the least doubt, absolutely mortal. All that can be required by judicial officers is a declaration that, in the opinion of the examiner, the life of the wounded person is in danger from the injury he has received; and on this they are sufficiently enabled to take all the precautionary steps that may be necessary. During the illness it will be proper to keep a journal, and, if the event prove fatal, we have a safe guide to resort to

* American Journal Med. Sciences, vol. xxiii. p. 246, from Continental and British Med. Review.

† Annales d'Hygiène, vol. xxii. p. 319. Dr. Gilman (New York Medical Gazette, vol. i. p. 33,) gives a case of a female stabbed with a sword-cane. The ascending aorta was found punctured. Death ensued in fifteen minutes. The external wound was small and nearly circular, but that in the aorta was triangular or V-shaped, answering exactly to the shape of the weapon.

in dissection. The wounded parts must be minutely examined, and from them a just conclusion can be drawn whether the injury was the cause of death.*

One circumstance, which I have delayed mentioning until the present, must not be forgotten by the examiner, viz., *that mortal injuries are not unfrequently inflicted without leaving any external marks.* Chaussier mentions an instance of a person crushed by a carriage, on whom no swelling or bruise could be discovered. Dr. Wagner, in his annual report for 1833 of the School of State Medicine in Prussia, relates the case of a child run over and killed, and in whom the spleen and kidney were crushed, while no external injury, except a very slight excoriation, was observable on the body.† In the case of a soldier struck with a cannon-ball obliquely on the left flank, and which produced no external wound, but an early death, Dupuytren discovered dreadful injury to the kidney, the lumbar vertebræ and nerves, the lower ribs, and the internal parietes of the abdomen.‡ Lastly, Dr. Meyer relates the following: Two men were in the act of lowering a heavy log of wood to the ground, when it slipped from their shoulders and fell on a little girl two and a half years old, who was walking behind them unperceived. The child died in a few minutes

* Foderé, vol. iii. pp. 402 to 432. I must briefly advert to one possible case, which may also occur, viz., that of a man wounded while laboring under a fatal disease. A trial involving this point, was held at the Hereford assizes, England, in 1830. A consumptive and intemperate person was struck severely on the head, and robbed. There were four contused wounds found. He recovered, however, from these, but ever after complained of pain in the head, more or less, until his death, which took place in four months, with the ordinary symptoms of consumption.

The question was, whether death had been hastened by the injuries. The surgeons differed in their testimony. Some state the brain to have been perfectly healthy; others, that it was soft, moist, and discolored; and through this difference the prisoner escaped from the charge of murder. The lungs were greatly diseased. (Midland Medical and Surgical Reporter, vol. ii. p. 228.)

On a recent indictment for murder in England, where the death was alleged to have been caused by a wound, it was ruled as not necessary to describe its length, breadth, or depth. (Rex v. Tomlinson, 6 Carrington and Payne's Reports, p. 370.)

† London Med. Gazette, vol. xiii. p. 974.

‡ Medico-Chirurg. Review, vol. xxv. p. 298.

without uttering a cry; and on examining the body, not the *slightest trace of violence could be found externally*; but on dissection, the fifth and sixth cervical vertebræ were found separated, the connecting ligaments being stretched without being lacerated. The spinal cord was not torn, but it had been evidently stretched, and on it, at this part, was found a coagulation of blood. The anterior wall of the stomach was ruptured and the liver lacerated.*

It is not necessary, in this place, to state the distinctions that exist in our law, and that of England, respecting the crime of killing, since they relate to the intent, and can have but a slight bearing on the nature of wounds. There is one English statute, however, which deserves mention. It was passed in the reign of James I., and declares "*that the thrusting or stabbing another who has not a weapon drawn, or who hath not then first stricken the party stabbing, so that he die thereof within six months after,*" shall be adjudged murder, though done upon sudden provocation.† In the State of New

* British and Foreign Med. Review, vol. vi. p. 543. For additional cases see Devergie, vol. i. p. 306; Poilroux, p. 53; London Med. Gazette, vol. xv. pp. 688, 727, 729; vol. xxvi. p. 349. In these last, either the liver, spleen, lungs, or intestines were ruptured, yet the surface of the body presented little if any marks of injury. (Lancet, N. S., vol. xxvi. p. 102.) Dr. Gairdner, in Edinburgh Medico-Chirurgical Transactions, vol. i. p. 662. Dr. Geoghegan, in Dublin Medical Press. Mr. Kingdon, in Lancet, March 22, 1845. The wheel of a coal-wagon went over the body of a boy. He survived five hours; and on dissection, the liver was found ruptured transversely, and the vertebræ fractured, yet there was not the least mark of external injury.

The explanation of this circumstance is doubtless to be found in the yielding nature of the walls of the abdomen. And although these cases have generally been the result of accident, yet it is *possible* that similar ones may be matters of legal investigation. "Trials for causing death by a rupture of the bladder have taken place, in which the witness denied that a blow was struck, simply because there was no ecchymosis externally, but no inference could be more erroneous." (British and Foreign Med. Review, vol. vi. p. 574.)

Dr. John Reid also mentions several instances in which a considerable quantity of blood was found effused into the cellular tissue (generally into the sheath of the recti muscles), and yet the external parts were of their natural color. In all these, however, there had been no injury inflicted. (Edinburgh Monthly Journal of Medical Science, vol. i. p. 17.)

† Blackstone, vol. iv. p. 193. Mr. Taylor states that this law is repealed by the 9th George IV. chap. 31.

York the same statute was enacted, and it contained the same provision as to time (*six months*). It is to be deemed murder, "although it cannot be proved that the same was done of malice aforethought."*

This is, however, omitted in the Revised Statutes, enacted in 1828, and therefore is no longer in force. The revisers, in recommending this alteration, and, indeed, in having no restriction as to time, remark that the presumption on which it was founded was unsound, viz., "that if the person wounded does not die within the given time, it must have arisen from some other cause. Common experience teaches the contrary."

In Scotland also, according to Mr. Watson, there is no limitation as to the time.

A provision as to a specific period during which death must follow in order to constitute the crime of murder appears, however, to have entered into the laws of various countries. Thus, among the Lombards, the criminal was held guilty, if the individual injured died within a year.† In Prussia, on the contrary, the *practice* is that the death must take place within nine days, although the *penal code* of that country contains no directions respecting this subject.‡ In France it is fixed at forty days;§ while in England the individual was held amenable for the consequences during a year and a day.¶ All these restrictions are evidently improper, since death may follow at a longer or shorter period of time, and be strictly and indisputably traced to the wound in question. It is a much safer mode to look at the intent, and proportion the punishment accordingly.

There are some adjudications on record which it may be well to mention, from their connection with the subject canvassed in the present and preceding sections.

* Revised Laws, vol. i. p. 67.

† Bohn, p. 101.

‡ Metzger, p. 325.

§ Ballard, p. 325.

¶ Blackstone, vol. iv. p. 197. This would also seem to be the present law in North Carolina, as in the *State v. Orrel*, the court said: "When the death does not ensue within a year and a day after a wound is inflicted the law presumes that it proceeded from some other cause; hence an indictment upon which it does not appear that the death happened within that time is fatally defective." (1 Devereux's North Carolina Reports, p. 139, quoted in the *American Jurist*, vol. vii. p. 366.)

It is stated by Starkie that it is sufficient to constitute murder that the party dies of the wound given by the prisoner, although the wound was not *originally mortal*, but became so in consequence of neglect or unskilful treatment; but it is otherwise where death arises not from the wound, but from unskilful applications or operations used for the purpose of curing it.*

On a recent trial, where an individual was indicted for manslaughter, by a blow of a hammer, Judge J. Parke observed: "It is said that the deceased was in a bad state of health; but that is perfectly immaterial, as, if the prisoner was so unfortunate as to *accelerate* her death, he must answer for it."†

The rule in Scotland does not appear to be so strict, although the general principle is maintained. Thus, it is not a good plea, if a person receives a gunshot wound at some remote place in the country, where no surgeon skilled in such wounds resides, and of which wound the person dies, although the practitioner there had exercised his best knowledge. (Case of Edgar, 1747.) And again, although the patient languishes, and death does not ensue even for weeks or months, yet if the wound be in itself severe, and goes on from worse to worse, so that the patient is plainly consumed by it as a disease, it is the

* Starkie on Evidence, vol. ii. p. 946. "If the death be truly owing to the wound, it signifies not that, under more favorable circumstances, and with more skilful treatment, the fatal result might have been averted. The true distinction in all such cases is, that if the death was evidently occasioned by grossly erroneous medical treatment, the original author will not be answerable; but if it was occasioned from want merely of the higher skill which can only be commanded in large towns, he will, because he has wilfully exposed the deceased to a risk from which practically he had no means of escaping." (Roscoe's Digest of the Law of Evidence in Criminal Cases, p. 576.)

† Rex v. Martin, 5 Carrington and Payne, p. 128. The Criminal Law Commissioners of the State of Massachusetts, in their proposed revision, decidedly accord in the correctness of this. In their exposition of what is to be understood by the term killing they mention, among other things, the following: "Where the hurt done is of a dangerous character, and the efficient cause of death, although there be a predisposing habit or condition of body without which it would not have been fatal, it is nevertheless a killing by means of such hurt." The same principle, they add, is contained in several of the revised codes on the continent of Europe. (American Jurist, vol. xxi. p. 332.)

same as if he died on the spot.* But in the case of Angus Cameron, in 1811, the deceased was an infirm and deformed lad, who died in consequence of a kick from a prisoner in the groin, where he had a rupture. The prisoner was ignorant of this, and he was sentenced to only six months' imprisonment. So also in another case, a blow on the shoulder dislocated the joint, and death ensued; but it was shown that the deceased was scrofulous and unhealthy, and the injury unskillfully treated. The verdict was culpable homicide only.†

3. *Of Mutilation.*

It will readily occur to the reader that there may be many wounds which, though not mortal in their nature, are still incurable; and these may either leave permanent deformity, or incapacitate or weaken one or more of the functions of the body. Laws directed to the punishment of such injuries have accordingly been enacted in various countries; and as such laws are in force in some parts of this country, the propriety of a brief notice is evident.

* Baron Hume's Commentaries, vol. i. pp. 269, 271.

† Alison's Principles of Criminal Law of Scotland, pp. 98, 100.

What constitutes the intent to commit murder? The following case is given in Carrington and Kirwan's English Nisi Prius Reports, vol. i. p. 176.

The indictment was for administering to Mrs. Day a certain poison called oxalic acid, with intent to murder.

It appeared that on the night of Saturday, the 1st of April, 1843, Mrs. Day had accused the prisoner, who was her servant, of stealing a table-cloth, and that, it being Mrs. Day's custom to take her breakfast in bed, the prisoner, on the morning of Sunday, the 2d of April, brought to her, into her bedroom, the tea-pot and cup and saucer, and there *left them and went down stairs*, and that on Mrs. Day's *having helped herself* to some of the tea from the tea-pot, she found it had an acid taste, and on its being analyzed, it was found to contain oxalic acid.

The jury found the prisoner "guilty of administering the poison, but not with intent to murder."

Baron Parke. That is tantamount to a verdict of not guilty.

It was urged by counsel that the prisoner might be convicted of an assault, under a recent English act, but the judges were of a different opinion. *Regina v. Draper.* (Amer. Law Journal, vol. i. p. 145, art. *Intoxication diminishing murder.*)

I will commence by mentioning those in force in France, as there is a uniformity between the English law and our own.

The code of 1791 established a scale founded on the proportionate magnitude of the injury. Whenever an individual was so wounded as to be unable to apply himself to any manual labor for the space of forty days, the criminal was directed to suffer two years' imprisonment. Three years were appointed in case the arm, leg, or thigh was broken; and four years, when there was an absolute loss of the sight of one eye, a complete loss of the use of a member, or a mutilation of some part of the head or body. It was extended to six years, provided there was an absolute blindness, or a total inability to use either both arms or both legs.*

The code now in force does not contain those distinctions, but leaves to the judges the power of varying the period of imprisonment. It is, however, in one respect more severe than the former, as it prescribes imprisonment generally against the individual who shall, either by wounds or blows, injure a person so that he is ill, or unable to labor, for the space of twenty days thereafter; and this imprisonment is to be not less than five, nor more than ten years.† One species of mutilation is,

* Foderé, vol. iii. p. 427.

† Foderé, vol. iii. p. 428; Penal Code, art. 309. Huard, in his valuable dissertation on wounds, objects to the above enactment. He considers it too severe, since there are some lesions that cannot be cured in twenty days, as fractures, violent contusions, and even sprains; and yet the violence may not have been more than, or even as much as, that which caused a wound which healed in twenty days. He urges a strong objection to these specifications of time, that there may be many circumstances, apart from the violence itself, which may delay the cure, and mentions several of those which we have enumerated in the first section of this chapter. The law in this country, he adds, is defective in not referring to the intent. Orfila and other French authors agree in this opinion. There has been an alteration of the law, (passed in 1824,) so far as relates to the degree of punishment. The court may reduce it if they think proper. The obnoxious specification of the crime, however, remains. (Orfila's *Leçons*, 2d ed., vol. ii. p. 422; *Law Review*, vol. xii. p. 13.) French law about assaults and their consequences, twenty days incapacitating from labor. (*Prison Discipline*, p. 212.)

By the 231st article of the Penal Code, if any violence be offered to a magistrate in the exercise of his duty, so as to cause effusion of blood, wounds, or sickness, the punishment is imprisonment; and if death follows within forty days, it is declared a capital offence.

however, particularly noticed, viz., castration. It subjects the criminal to hard labor for life; and if it should prove fatal within forty days, he is to suffer death. Outrages against decency are alone to excuse from this punishment.*

In the English law, the term *mayhem* is applied to the cases now under notice. This is defined by Blackstone to be "the violently depriving another of the use of such of his members as may render him the less able, in fighting, either to defend himself, or annoy his adversary. And therefore the cutting off, or disabling, or weakening a man's hand or finger, or striking out his eye or fore tooth, or depriving him of those parts, the loss of which in animals abates their courage, is held to be mayhem. But the cutting off his ear, or nose, or the like, is not held to be mayhem at common law, because such injuries do not weaken, but only disfigure him."

"By the common law, also, mayhem has for a long time been only punishable with a fine and imprisonment, unless perhaps the offence of mayhem by castration, which all our old writers held to be felony; and this, although the mayhem was committed upon the highest provocation."†

It is under this description of trials that the reader of French law cases will frequently observe a verdict brought in of guilty, with "*circumstances atténuantes*;" and he should understand that these words have not their ordinary English acceptance. It is not a recommendation to mercy, but a judgment of the jury binding on the court, and deprives it of the power to inflict as high a penalty as they could have given had a general verdict of guilty been returned. (Law Review, vol. xii. p. 6.)

* Foderé, vol. iii. p. 244. Castration, according to the laws of France, is the removal of any organ necessary to generation. The amputation of the penis will therefore constitute one form of the crime.

† The ancient Anglo-Saxon laws contained a regular scale of fines for personal injuries of this description. The loss of a leg or eye subjected the offender to a fine of fifty shillings; a wound that caused lameness, thirty shillings; one that caused deafness, twenty-five shillings; piercing the nose was punished with a fine of nine shillings; a front tooth was compensated for by six shillings, and an eye-tooth by four shillings. Money, it must be remembered, was in those days one hundred times more valuable than at present. (Edinburgh Encyclopedia, vol. ii. p. 94, American ed.)

For these in detail, as well as the laws of the ancient Lombards, the Angles, and the Salic law on the punishment for mutilation, see Dunham's History of Europe during the middle ages. (Lardner's Cyclopaedia, vol. i. p. 14; vol. ii. p. 134; vol. iii. pp. 65, 72, 130.) [See also the whole of these,

Subsequent statutes have, however, more clearly defined the crime and its punishment. By a statute passed in the fifth year of Henry IV., it was enacted that beating, wounding, or robbing a man, and then cutting out his *tongue*, or putting out his *eyes*, shall be considered a felony. Next was the statute 37 Henry VIII., which directs that if a man shall maliciously and unlawfully cut off the *ear* of any of his majesty's subjects, he shall not only forfeit treble damages in a civil suit, but ten pounds by way of fine to the king, which was his criminal amercement. After this the Coventry Act was passed, in the reign of Charles II., so called from its being occasioned by an assault on Sir John Coventry in the street, and slitting his nose, in revenge (as was supposed) for some obnoxious words uttered by him in parliament. This ordains, that if any shall, of malice aforethought, and by lying in wait, unlawfully cut out or disable the *tongue*, put out an *eye*, slit the *nose*, cut off a *nose* or *lip*, or cut off or disable any *limb* or *member* of any other person, with *an intent to maim or to disfigure* him, he shall be deemed a felon without benefit of clergy.*

A more recent act was passed in the 43d of George III. All willful and malicious maiming, stabbing, or cutting, with intent to murder, rob, *maim, disfigure or disable, or to do some grievous bodily harm*, is declared felony.

All these (except the statute of Henry VIII.) were repealed by a law passed in the 9th of George IV., chapter 31. Here it is enacted that if any person shall maliciously shoot at another, or cut, stab, or wound, with intent to maim, disfigure, or disable, or to do some other grievous bodily harm, it shall

and the laws of other medieval nations, in the collection entitled *Corpus Juris Germernici Antiqui, ex optionis subsidüs colligit, edidit et locupetissimos indices adjicit* Fred. Walter. Tome iii. 8vo.; Berolini, 1824.—J. W.]

In China "a limit is allowed to the period of responsibility in all cases where the homicide was evidently not preconcerted. When a person is wounded with only the hands or a stick, twenty days constitute the term of responsibility, after which the death of the sufferer does not make the offence capital. With a sharp instrument, fire, or scalding water, the term is extended to thirty days. In case of gunshot wounds, to forty days; of broken bones, or very violent wounds, fifty days." (The Chinese, by J. F. Davis, vol. i. p. 232.)

* Blackstone, vol. iv. pp. 205, 206, 207.

be deemed felony in all cases where, if death had ensued, it would have amounted to murder.* Some interesting decisions have been made in England under these respective laws; and as they are, in a degree, applicable to our own statute, I will mention a few:—

In 1721, Mr. Coke, a gentleman of the bar, and one Woodburne, were indicted, the one for hiring and abetting, the other for actually slitting the nose of Mr. Cripse, the brother-in-law of Coke. On the trial, Mr. Sturgeon, the surgeon, swore that there were several wounds on the face; one wound divided the right side of the nostril, and made an oblique cross over the wound, and ended near the right under jaw. The nose was cut from without into the nostril; the edge of the nose was not cut through, but there was a cut or slit in it that went through. Mr. Coke, with great effrontery, said that his aim was to murder, and not to maim or disfigure. When the verdict of guilty came in, he asked whether the nose could be said to be slit, within the meaning of the statute, when the edge of it was not cut through? To this the lord chief justice (Sir Peter King) replied: "It is true, the edge of the nose was not slit, but the cut was athwart the nose, which cut separated the flesh of the nose, and cut it quite through the nostril. This I take," he added, "to be a slitting of the nose, and the *surgeon swore the nose was slit.*" Both Coke and Woodburne were executed.†

* It is stated in the London Law Magazine (vol. i. pp. 130, 132,) that Lord Lansdowne's Act, as this last (9 George IV.) is called, originated in an attempt of one Howard to murder with a *blunt* weapon. Lord Ellenborough's Act (43 George III.) was restricted to shooting, stabbing, or cutting. It is urged against the present law that it is too extensive; that it may be construed to include common broils, and an ordinary assault and battery may be made a felony, and be punished with death.

And again, cases have occurred where persons committing "grievous bodily harm" by shooting, or cutting with a knife, have *totally* escaped punishment, because the crime, if the party had died, would have amounted only to *manslaughter*. (Taylor, p. 495.)

† Hargrave's State Trials, vol. vi. p. 211. Lord Campbell, in his *ives of the Lord Chancellors*, (vol. iv. p. 601,) notices this case, and makes some statements which are highly worthy of consideration. "Although," he says, "substantial justice was done, and the decision has since been recognized, I must confess that it seems to me that the law was rather strained."

The prisoners being called upon for their defence, Coke boldly contended

In the case of one Carrol at the Old Bailey sessions, in July, 1765, it appeared that he had struck the prosecutor (Mr. Kirby) with a razor-bladed knife across the nose and eyes; and, upon examination, it appeared that the two great blood-vessels in the forehead were divided; that there was a large transverse wound across the nose, so wide open that the bone was visible. It began from the right, and went across the eyelids and across

that this case did not come within the Coventry Act. "This act, as was well known from its history, and as was apparent from its terms, was meant to apply to the outrage of maiming or disfiguring a man when there was no intention of depriving of life, but who was afterwards to gratify the malice of an enemy by carrying about with him, and exhibiting in society, the mark of disgrace set upon his person. The attempt to put a fellow-creature to death might morally be a higher crime, but not being the crime described in the statute, it remained as at common law, only an aggravated misdemeanor, to be punished by fine and imprisonment. The legislature might hereafter be called upon to make such an attempt a capital offence, but a court of justice could not properly extend it to a statute passed entirely *alio intuitu*. Now here there clearly was no intent that Mr. Crispe should live ridiculous with a mutilated visage; the intention was not to disfigure, but to murder him for his estate; the wound which merely cut the nose was intended, like others inflicted on different parts of his body, to be mortal, and both the accused persons, when they left him in the church-yard, believed that their real object had been fully accomplished."

Lord Chief Justice King, however, ruled that if the prisoners maliciously inflicted a wound which amounted to a slitting of the nose, and which disfigured the prosecutor, the case was within the act, although the real object was to murder, not to disfigure; saying, among other things, "There are cases in which an unlawful or felonious intent to do one act may be carried over to another act done in prosecution thereof, and such other act will be felony, because done in prosecution of an unlawful or felonious intent. Here, although the ultimate intention was to murder, there might be an intermediate intention to disfigure, and one might take effect while the others did not. An intention to kill does not exclude an intention to disfigure. The instrument made use of in this attempt was a bill or hedging-hook, which in its own nature is proper for cutting, maiming, or disfiguring. The means made use of to effect the murder must be considered, and the jury will say whether every blow and cut, and the consequence thereof, were not intended, as well as the end for which it is alleged these blows and cuts were given."

The prisoners were convicted and executed; but the case (says Lord Campbell) may be regarded as a pendant to that before Lord Chief Justice Sir James Mansfield, where a man who gave a horse a draught for the purpose of fraudulently winning a wager on a race, was hanged for killing a horse, "out of malice to the owner," whose name he did not know.

the nose. The muscles of the nose were cut through, and it proceeded to the left eyelid and terminated at the temple. A nerve was also cut. It was stated in evidence, that in many old writers on surgery such wounds were called slits, but that slit is not the word made use of now. The word *slit* is understood as synonymous to the word *cut*, but the idea which was formerly conveyed by the word *slit* is now expressed, in speaking technically, by the word *divided*. The jury found the prisoner guilty, but it was questioned whether a transverse cut was a slitting, within the meaning of the act, *the wound not having perforated the nostril*. It was accordingly referred to the judges, who held that the offence was properly proved, and the prisoner was accordingly executed.*

Lastly, one Tickner was tried in 1788, at the Old Bailey, under the same act, for injury done to William Jacob. There were several wounds on various parts of the body, but the cut on the nose had divided the integuments in an oblique direction. It went down to the bone, but not through the bones of the nostrils, nor did it penetrate to the nostrils, and was rather a scratch than a slit. It was, however, sufficient to leave a mark visible for some time. The prisoner was convicted, but Sergeant Glynn ordered the execution to be respited until the opinion of the twelve judges could be procured, whether this conviction was proper within the meaning of the Coventry Act. They were of opinion that the conviction was right.†

Under the act of the 43d of George III., for malicious shooting or cutting, there have been the following adjudications:—

A striking on the face with a sharp claw of a hammer, by which the face was cut, was held to be within the act. (Atkinson's case, York assizes, 1806.)

So also cutting part of the skull with an instrument adapted

* East's Treatise, p. 339; Lawyer's Magazine, vol. i. p. 202.

† Lawyer's Magazine, vol. i. p. 203. William Lee was tried at the Old Bailey, in 1763, for attempting to cut his wife's throat with a razor, while asleep. The wound was three inches in length, and quite across, but did not prove mortal. This was held not to be an offence within the Coventry Act.

to the purpose of prying doors open; a piece of the skull, according to the evidence, having been taken out as if sawed out; not *broken out*, but *cut out*. *Rex v. Hayward or Harwood*, 1805. The jury found that the intent was not to *cut* but to *break or lacerate* the head. The judges held that this conviction was right, and the prisoner was executed.

In Adams' case, Old Bailey sessions, 1808, and afterwards before the judges, it was held that the striking with a square iron bar was not within the statute; because there the wound was not an incised one, but contused and lacerated.*

In a case where the prisoner assaulted a female child ten years old, and, with a knife, made a slight laceration, extending from between the labia, and below about an inch in length, but without penetrating the hymen, the judge told the jury that they were to consider whether this was not a grievous bodily harm, within the meaning of the act. As to the intent, though it probably was the prisoner's intention to have committed a rape, (he was disturbed while inflicting the wounds, and ran away,) yet if to effect a rape, he did that which the law made a distinct crime, he was not the less guilty of that crime. The jury found him guilty, and the judges held the conviction right.†

Under the 9th of George IV. as quoted, I find the following decisions:—

A man was struck with a hammer, his collar-bone was broken, and his back and loins bruised. It was urged that was not a wounding, as the *skin was not broken*. The judge left the case to the jury, but reserved the point; and the judges agreed that this was not a wounding under the act.‡

Again, a wound caused by throwing a sledge-hammer is a wound within the statute, although the hammer was blunt, and not an instrument calculated to inflict a wound.§ And even if the skin be broken with a bludgeon, and blood be drawn, this is a wounding.|| If a person wound by kicking the skin off

* Starkie on Evidence, vol. ii. p. 924.

† *Rex v. Cox*. Russel and Ryan's Crown Cases Reserved, p. 362.

‡ 4 Carrington and Payne, p. 381. *Rex v. Wood*.

§ *Ibid.*, p. 446. *Rex v. Withers*.

|| *Ibid.*, p. 558. *Rex v. Payne*.

one he intends to rob, he is punishable under this act, if the jury find that his act is either to disable or to do grievous bodily harm.*

The technical difficulties attendant on these decisions appear to be obviated by a law recently passed, (1 Victoria, chap. lxxxv.) This statute repeals, after a certain period, the provisions of the act last noticed, and substitutes the following, which I quote in full, to prevent the necessity of repetition in other places:—

1. The punishment for administering poisons, or doing other bodily injury with intent to commit murder, shall be felony and death.

2. The punishment for offences with intent to commit murder, though no bodily injury be effected, shall be felony and transportation for life, or for not less than fifteen years, or imprisonment not exceeding three.

3. The punishment for cutting and maiming, with intent to disfigure, or to do some grievous bodily harm, or with intent to resist or prevent the lawful apprehension or detainer of any person, shall be felony and transportation for life, or for not less than fifteen years, or for imprisonment not exceeding three years.†

In the State of New York the law at present is as follows:

Every person who, from premeditated design, evinced by lying in wait for the purpose, or in any other manner; or with intention to kill or commit any felony; shall cut out or disable the tongue; or put out an eye; or slit the lip, or slit or destroy the nose; or cut off or disable any limb or member of another, shall, on conviction, be imprisoned in a State prison for a term not less than seven years.‡

With respect to the other States, the following classification of offences may probably be most satisfactory:—

Cutting out or disabling the tongue is specified in the laws of

* 5 Carrington and Payne, p. 504. *Rex v. Shadbolt*.

† Companion to the British Almanac, 1838, p. 159; British and Foreign Medical Review, vol. v. p. 173.

‡ Revised statutes, 1828, vol. ii. p. 664.

Connecticut, Massachusetts, Rhode Island, Delaware, Vermont, Illinois, New Hampshire, New Jersey, Tennessee, Missouri, Georgia, and Michigan. *Disabling the tongue* is only mentioned in the laws of Indiana.

Putting out an eye is made a crime in the laws of Connecticut, Pennsylvania, Rhode Island, Delaware, Vermont, Ohio, Illinois, New Hampshire, New Jersey, Missouri, Tennessee, Georgia, Massachusetts, and Michigan. Putting out the eye or eyes of another, so that the person is thereby made blind, is particularly specified as a higher offence in Connecticut, and the punishment is imprisonment for life in the State prison. Pulling out or putting out an eye while fighting, is mentioned in the laws of Pennsylvania, Rhode Island, and Georgia.

Slitting the nose, ear, or lip, is mentioned in the laws of Connecticut, Illinois, Georgia, New Jersey, Michigan, Delaware, Indiana, Tennessee, Ohio, New Hampshire, and Massachusetts.

Slitting the nose or lip, in Missouri.

Slitting the nose, in Pennsylvania and Rhode Island.

Cutting off the nose, or ear, or lip, in Pennsylvania, Rhode Island, Delaware, Indiana, Tennessee, Ohio, New Hampshire, Michigan, New Jersey, Missouri, and Massachusetts.

Biting off the nose, ear, or lip, in Delaware, Indiana, Tennessee, and Ohio.

Cutting off, biting, or slitting the tongue, in Ohio.

Cutting off all or any of the genitals, in Connecticut, Pennsylvania, Vermont, Tennessee, Delaware, and North Carolina. In the two last States this crime is punishable with death.

Cutting or biting off, or disabling any limb or member, with an intention to maim or disfigure, is enumerated in the laws of Connecticut, New Hampshire, Michigan, New Jersey, Missouri, Tennessee, Georgia, and Massachusetts.

Cutting off or disabling any limb in Rhode Island, Pennsylvania, and Ohio.

Maiming any person in Delaware. *Disabling any limb or member* in Illinois.

Branding any person with intent to murder or kill, disfigure, or maim in New Jersey and Michigan.

*Shooting or stabbing with any weapon, with intent to kill or maim, in Tennessee and Missouri.**

* Laws of Connecticut, 1830, p. 254. Laws of Massachusetts, 1807, vol. iii. p. 283. With reference to this State, see also the case of the Commonwealth v. Newell and others. (Massachusetts Reports, vol. vii. p. 245.) Laws of Rhode Island, 1798, p. 589. Laws of Vermont, 1825, p. 254. Revised Laws of Illinois, 1833, p. 178. Laws of New Hampshire, 1830, p. 137. Laws of New Jersey, 1833, p. 237. Statute Laws of Tennessee, 1831, vol. i. p. 251. Laws of Missouri, 1825, vol. i. p. 283. Digest of the Laws of Georgia, 1822, p. 449. Laws of Michigan, p. 207. Revised Laws of Indiana, 1831, p. 183. Revised Laws of Delaware, 1829, p. 128. Laws of Delaware, 1833, p. 282. Laws of Pennsylvania, 1803, vol. v. p. 3. For the Laws of Ohio see American Quarterly Review, vol. x. p. 41. In North Carolina (session of 1831-1832) castration, with intent to murder or maim, was made a capital crime. (American Jurist, vol. viii. p. 197.) Under 1st Victoria, sect. 5, chap. 85, a wife, who, through jealousy, poured boiling water over the face of her husband, while asleep, and into one of his ears, was convicted. She ran off, boasting that she had boiled him in his sleep. The man was for a time deprived of his sight, and permanently lost the hearing of one ear. Baron Rolfe reserved the point whether the boiling water is "a destructive matter;" and the fifteen judges held that the conviction was right. (Regina v. Crawford, 2 Carrington and Kirwan, 129.)

CHAPTER XVI.

POISONS.

Definition of a poison. Resistance to poisons sometimes observed in man and animals. Modes in which poisons may be introduced into the system—variety as to the rapidity of their effects—laws founded on this circumstance. Division of poisons into irritant—narcotic—narcotico-acrid. 1. SIGNS OF POISON IN THE LIVING BODY. Symptoms of the irritant poisons—the narcotic—the narcotico-acrid. Causes that may modify or vary the progress of symptoms. Preliminary directions for the analysis of suspected substances—administration of the supposed poison to animals—mode—value of the evidence thus obtained. Of poisoning during illness—value of moral evidence. Of the poisons of the ancients, and what have been called slow poisons. Of poisons administered to several persons at the same time—variety of effects. Of poisoning as the result of suicide or homicide—pretended poisoning. Diseases and symptoms that may be mistaken for the effects of irritant poisons—idiosyncrasy—distention or rupture of the stomach, intestines, and other abdominal organs—cholera— inflammation—perforations—hæmatemesis—colic. Of narcotic poisons—apoplexy—epilepsy. 2. SIGNS OF POISON ON THE DEAD BODY. Danger of neglecting a medico-legal dissection—cases. Preservation of the contents of the stomach and intestines. Appearances on dissection from the irritant poisons—narcotic—narcotico-acrid—variety in these. Introduction of poison after death—appearances indicative of this. Appearances and diseases that may be mistaken for the effects of poisons. Vascularity of the stomach after death—how discriminated from the effects of inflammation. Ulcers or perforation of the stomach and intestines, through the action of the gastric juice, or as a consequence of disease—how these are to be distinguished from perforations induced by irritant poisons. Chemical examination—the poison cannot always be detected—being removed by vomiting—absorption—decomposition—should then be sought for in the solids. How far putrefaction renders their detection impossible—general outline of treatment—antidotes—removal of the poison by vomiting—the stomach-pump—cupping-glasses. Statistics of poisoning in France.

“THE means of ascertaining the traces of poisons, either on the living or the dead body, is one of the most important

subjects in legal medicine, and its importance is only equalled by its difficulty."

I propose to consider the subject under three general divisions:—

1. The signs of poison on the living body.
2. The signs of poison on the dead body.
3. The various kinds of substances that may produce, or have produced, these dangerous and fatal effects.

Previous to an examination of these, a few preliminary observations will be proper.

What is a poison? The ancients considered everything as poisonous that produced malignant symptoms, and attacked directly what we style the vital principle. Dr. Mead's definition includes every substance which, in small doses, can produce great changes on the living body. Foderé considers poisons to be those substances which are known by physicians as capable of altering or destroying, in a majority of cases, some or all of the functions necessary to life.* [The definition given by Guy (Med. Jur., 393, Lond. ed.) seems to me so good that I here insert it. "A poison is any substance which, when applied to the body externally, or in any way introduced into the system without acting mechanically, but by its own inherent qualities, is capable of destroying life.—C. R. G.]

The great and leading object in medico-legal cases, necessary to complete the idea of a poison, is the intent with which the substance is given.

Another interesting question is the manner in which poisons act. This has been a subject of fruitful discussion among modern physiologists, and our own country has not been wanting in ardent examiners respecting it.†

It is not compatible with the limits of this work to enter

* Foderé, vol. iii. p. 449.

† See Ducachet's Inaugural Dissertation on the action of poisons. Somerville's Inaugural Dissertation on the organs of absorption. (Chapman's Journal, vol. ii. p. 408.) Reports of the Academy of Medicine, on the means by which absorption is effected. (Ibid., vol. iii. p. 282.) Dr. Milner's experiments. (Ibid., vol. iv. p. 10.) Dr. Hubbard's Experiments. (Ibid., vol. iv. p. 242.) Dr. Lawrence and Coates' experiment. (Ibid., vol. v. p. 327.) Also Dr. Hale's Boylston Prize Dissertation.

into a full consideration of this subject, and a brief account would only provoke criticism. The varied results obtained by different experimentalists have inclined them respectively in favor of the blood-vessels, the nerves, or the lymphatics, as the medium by which poisons produce their effects.*

A concise notice of the consequences observed from each individual poison will be more appropriate to the object of the work, and this will accordingly find its proper place in the third division of the subject.

The remarkable resistance that is sometimes observed to the action of poisons, also deserves an early allusion. Instances of this nature are so numerous that a selection of the more striking will be sufficient to illustrate the position.

Among the Hungarians, the seeds of the *Palma Christi* are often taken, to the amount of thirty-six grains, without any inconvenience; and some of the French peasantry use a decoction of *colocynth* as a common purgative. The common dose of the extract of the *aconitum napellus* is one or two grains, and it is deemed dangerous to use it in larger quantities; but Foderé was consulted concerning the case of Charles IV. of Spain, who, while residing at Marseilles, was attacked with a

* Among European writers on this subject, I may venture to mention Christison, chapter i.; Addison and Morgan, on the operation of poisonous agents, London, 1829; the experiments of Segalas, in Brande's Journal, vol. xxi. p. 401; Dr. W. C. Henry, Philosophical Magazine and Annals, vol. x. p. 293; Cyclopaedia of Practical Medicine, art. *Toxicology*, by Dr. Apjohn; Edinburgh Medical and Surgical Journal, vol. xxxii. p. 129; Magendie's Lectures on absorption, in Lancet, N.S., vol. xv.; Tiedemann's experiments on the pulmonary exhalations, in British and Foreign Medical Review, vol. i. p. 241. Blake on the action of various saline substances, when introduced into the vascular system. Edinburgh Med. and Surgical Journal, vol. liv. p. 339. Blake on the action of physiological agents introduced into the circulation, and the same author on the mode in which various poisonous agents act on the animal body. Ibid., vol. li. p. 330; vol. liii. p. 35. In the last paper, Mr. Blake advances his belief, deduced from a series of experiments, that poisons act by absorption, having established that the interval between the absorption of the capillaries and their general diffusion through the body may not exceed nine seconds.

In addition to the above, Mr. Blake has written on the action of certain inorganic compounds, when introduced directly into the blood, *ibid.*, vol. lvii. p. 104; on the action of poisons, *ibid.*, vol. lvii. p. 412; London Med. Gazette, vol. xxviii. p. 507.

rheumatic gout, and he recommended the medicine in question. M. Soria, the king's physician, replied that at a former period it had been administered for a length of time, and to such an extent that the patient took a drachm daily, without any good or evil effects. This monarch was now sixty-two years of age, athletic, and had an excellent appetite.* The fumes of mercury, of lead, and of copper, are well known to be injurious to those who inhale them, yet no fact is better established than that of workmen resisting their effects for many years. "In the mines of Peru," says Humboldt, "from five to six thousand persons are employed in the amalgamation of the minerals, or the preparatory labor. A great number of these individuals pass their lives in walking barefooted over heaps of brayed metal, moistened and mixed with muriate of soda, sulphate of iron, and oxide of mercury, with the contact of the atmosphere and the solar rays. *It is a remarkable phenomenon*, he adds, "*to see these men enjoy the most perfect health.*"† Again, in all the Savoyard and Swiss Alps, milk is collected and kept in small copper vessels; and in Germany, preserved fruits are put into vessels of this metal, in order to give them a green color, and all without inducing any injury.‡ The most astonishing of cases, however, on record, is that of the old man at Constantinople, who had been in the habit, for thirty years, of swallowing enormous quantities of corrosive sublimate, until his dose came at last to be a dracham daily. He was living in 1800.§

These exceptions to general rules are best explained on the

* Foderé, vol. iii. p. 468.

† Political Essay on the Kingdom of New Spain.

‡ Foderé, vol. iii. p. 449.

§ This case was first mentioned by Dr. Pouqueville. Mr. Thornton doubted the story, and criticised the name given him. Lord Byron, in the notes to his *Childe Harold*, attacked Mr. Thornton in his turn. And thus, "this man," says Mr. Hobhouse, "though nearly one hundred years old, was, like Partridge, the almanac maker, almost reasoned out of existence by a verbal criticism, which has turned out to be incorrect." (Hobhouse's *Albania*, vol. ii. p. 945. London edition.)

Dr. Strohmayer relates that a peasant, who resided near a convent in the Tyrol, took for a long time ten grains of arsenic daily with his food. The monks fully testify to the truth of this statement! (Boston Med. and Surgical Journal, vol. xii. p. 211.)

principle of idiosyncrasy, or of habit rendering the system insensible to their effects.* And such extraordinary instances should, above all, never influence us in legal medicine, nor lead us to the idea, that because one person has taken a particular substance without any ill effects, it is therefore not a poison. The academy of Berlin was consulted in 1752, whether copper was a poison. They replied that they did not consider it decidedly so, since several had taken it with impunity, either separately or mixed with food. Now, if this decision receives a general application, we may undoubtedly adduce examples of wonderful escapes from the effects of almost all noxious substances, and thus destroy the idea of poison altogether.

There is another curious fact connected with this subject, which it is proper to mention. It is the different effects which some substances produce on man and other animals—being noxious to one, and innoxious to the other, and vice versa. Thus, sweet almonds are said to kill dogs, foxes, and fowls; aloes is destructive to dogs and foxes; pepper to hogs, and parsley to the parrot. On the contrary, hogs feed on henbane, (hyoscyamus,) pheasants on stramonium, and goats on water-hemlock, (cicuta virosa,) with impunity.† Many, however, of the principal poisons produce similar results on man and other animals, and in none probably is the resemblance greater than with the dog.

Poisons may be introduced into the system in various ways: through the nose, in the form of odors; through the lungs, by inspiration; by the mouth and œsophagus, in the form of food;

* The quantity of opium taken daily by the Turks is also a striking proof of this.

† Foderé, vol. iv. p. 203; Mahon, vol. ii. p. 302. Dr. Christison is disposed to doubt many of these statements.

The elephant exhibited at Geneva, Switzerland, in 1820, took three ounces of prussic acid, mixed with ten ounces of brandy, without any effect. Three boluses of an ounce of arsenic each, mixed with honey and sugar, were then offered, and he took them all, but without any result. (Anglada, p. 40, from the Bibliothèque Universelle.)

It is stated by Pallas, that the hedgehog will eat the Spanish fly with impunity.

by the rectum, in the form of injection, and through the skin, in some instances, by absorption.*

The rapidity of the action of poisons varies considerably. Concentrated hydrocyanic acid destroys an adult man, as we shall see, almost in an instant; while others take away life within an hour, a few hours, a day, or a longer period. Some, indeed, when the sufferer escapes the immediate consequences, prove fatal after months or a year, but with a sufficiently marked train of symptoms so indicate with certainty the original cause. It is on this account that a particular period has been introduced in the laws of some countries, and if the poisoned persons dies within it, the criminal is to suffer punishment.

In England, it is deemed murder if the party poisoned die within the year; while in Scotland, according to the opinion of Baron Hume, it would seem that a person might be punished, although death took place at a period indefinitely remote, provided the operation of the poison can be distinctly traced as causing it.† In the State of New York, the law formerly was similar to the English. If the individual poisoned died within a year and a day, it was murder; if beyond that, the punishment was imprisonment in the State prison for a term not exceeding fourteen years.‡ This enactment is,

* There are many curious accounts on record of the mode in which poisoning was formerly supposed to be perpetrated. Thus Zacchias says that Pope Clement VII. was poisoned by the smoke of a candle; and it was also thought that dresses and jewels might be impregnated with venomous matters. Queen Elizabeth was to have been poisoned by spreading some on the pommel of the saddle. "The queen, in mounting, would transfer the ointment to her hand; with her hand, she was likely to touch her mouth or nostrils, and such was the virulence of the poison, that certain death must follow." (Aikin's *Memoirs of Queen Elizabeth*, American edition, vol. ii. p. 306.) There is a minute of council extant, in the handwriting of Cecil, which contains, among other things, the following caution: "That no manner of perfume, either in apparel or sleeves, gloves, or such like, or otherwise, that shall be appointed for your majesty's savor, be presented by any stranger or other person, but that the same be corrected by some other fume." (*Ibid.*, vol. i. p. 299.)

Of all or most of these, we may remark that they are altogether fabulous—the suggestions of ignorance or malice.

† Christison, p. 39.

‡ Revised Laws, vol. i. p. 409.

however, omitted in the Revised Statutes; and it is now provided, that "if any person shall be convicted of having administered, or having caused and procured to be administered, any poison to any other human being, with intent to kill such human being, and which shall have been actually taken by such being, whereof death shall not ensue, he shall be punished by imprisonment in a State prison for a term not less than ten years."*

In all the States, willful but unsuccessful attempts to destroy life by poison are ranked among the higher crimes; but I cannot find any limitation as to time.† In England, the administration of any poison or other destructive thing, or causing it to be taken, is, by a recent act, declared felony.‡ In France,

* Revised Statutes, vol. ii. p. 665. The following are also made offences: "Mingling poison with any food, drink, or medicine, with intent to kill or injure any human being; willfully poisoning any spring, well, or reservoir of water: and administering or exposing any poisonous substance, so that it should be taken by any horse, cattle, or sheep." (Ibid., pp. 665, 689.) "If any physician, while in a state of intoxication, shall, without a design to effect death, administer any poison, drug, or medicine, or do any other act to another person, which shall produce death of such other, he shall be deemed guilty of manslaughter." (Ibid., p. 662.) If, under the same circumstances, a physician or any other person prescribes either of the above, and life is endangered, it is declared a misdemeanor. (Ibid., p. 694.)

† The following cases show that the laws punish such as use poison, even when the individual whom they intend to destroy does not take it, but some third person accidentally does. A. intending to kill his wife, gave her a poisoned apple; and she, being ignorant of it, gives it to a child, against whom A. never meant any harm. The child died. A. was convicted on this for murder. (Saunders' Case, Plowden's Reports, p. 473.) Again, if A. sends poison, intending it for B. and with intent to kill him, and it comes into the possession of C., who takes it, but does not die, A. may be indicted for a capital offence under the 9th George IV., chap. xxxi. sec. 11. *Rex v. Lewis*, 6 Carrington and Payne's Reports, p. 161.

‡ 9 George IV., chap. xxxi. sec. 11. Under this act, Justice Parke decided that putting arsenic into coffee was administering poison, or causing it to be taken. *Rex v. Harley*, 4 Carrington and Payne's Reports, p. 369. I observe, however, that it is doubted whether this is law under the new criminal statute of 1 Victoria, (see p. 274.) At all events, if so, it is included in the general description of "causing any poison or other destructive thing to be taken." (London Law Magazine, vol. xix. p. 58.) In a recent case, a person who put cantharides into coffee in order that another might take it, and it was taken, was found guilty of an assault on the person who took it. (8 Carrington and Payne, 660; *Regina v. Button*.)

every attempt to destroy life by giving poison is punishable with death, (Code Penal, art. 301;) but under this, a curious question has arisen in that country. An individual, intending to poison his wife with sulphuric acid, gave it to her mixed with wine. It proved harmless. After a trial, and several reviews of it by superior courts, he was acquitted. It thus appears, that if the criminal, through ignorance, renders the poison innoxious, he is not to suffer for his malicious intent.*

In the former edition, when noticing the action of individual poisons, I pursued the arrangement adopted by Foderé and Orfila. This was to consider them under six divisions, viz., *Corrosive, astringent, acrid, narcotic, narcotico-acrid, and septic*. Subsequent examination has convinced me that this is too minute; that it unnecessarily separates some, and that a class is introduced (the septic) which can have no existence. I have therefore adopted the division used by Professor Christison, and shall consider poisons under the three grand classes of

IRRITANTS, NARCOTICS, and NARCOTICO-ACRIDS.

1. *Signs of poisons on the living body.*

A person is supposed to be poisoned if, being in perfect health, he is attacked, after having taken some food or drink, with violent pain, cramp in the stomach, nausea, vomiting, convulsive action, and a sense of suffocation; or if he be seized, under the same circumstances, with vertigo, giddiness, delirium, or unusual drowsiness.†

All these symptoms may, however, be the effect of sudden illness, and the examiner should therefore recollect whether an epidemic or sporadic disease, resembling that of the patient, does not exist. He should also inquire into his strength, mode of life, and habit of body, and ascertain whether he had pre-

* Devergie, vol. ii. p. 426.

† These are the most striking *preliminary* symptoms. Mahon has collected a long list from the older writers, which, however, includes most of the appearances observed during the whole progress of the action of poisons. It is evidently too general to be of much practical value. (See Mahon, vol. ii. p. 263.)

vously complained of ill health. The time at which the noxious substance was taken, and the vehicle in which it was given, the taste or odor that was perceived on its administration, and the food or drink that has been lately swallowed, are all subjects that require particular notice.

Poisons, also, are generally characterized by the rapidity with which the symptoms follow each other, and by their steady march to a fatal termination. For this, however, as with the early affections, there may be other causes assigned, independent of the action of noxious substances. Nor are these effects invariable, although common. Some of the most fatal, as arsenic, are occasionally accompanied with remission; others, as *nux vomica* and its alkaloid, attack in paroxysms. There is also no doubt but that, as suggested by Dr. Christison, the occurrence of sleep, immediately after taking some of the irritant poisons, may retard the development of symptoms.

Having formed an opinion from a review of the above circumstances, that a poisonous substance has been taken, the next question that arises is, to what class it belongs. Although (as I have already remarked) the symptoms of poison are somewhat equivocal and unsettled, yet there are certain leading and characteristic appearances which, in a majority of cases serve to distinguish the two great divisions from each other. And these two are the *irritant* (corrosive or acrid) and the *narcotic*.

"The class of *irritant* poisons comprehend both those which have a purely local, irritating action, and likewise many which also act remotely, but whose most prominent feature of action still is the inflammation they excite wherever they are applied."*

We may suppose that one of this class is the cause of present disease, if the patient has observed that the food or drink which was its vehicle had not its ordinary taste; if he has felt a heat, an irritation, or an extraordinary and sudden dryness at the root of the mouth and œsophagus, with a constriction or sense of strangling in those parts; if this be succeeded by an

* Christison, p. 96.

obstinate anxiety to vomit, and sharp pains in the stomach and intestines; if there be great thirst, copious discharges by vomiting and by stool, accompanied with tenesmus and followed by hiccough, by a sense of constriction across the diaphragm, a difficulty of breathing; if there be great pain in the region of the kidneys, followed by strangury; if convulsions, cramps of the hands, trembling of the lips, extinction of the voice, repeated faintings, cold sweats, and a small, corded, and irregular pulse be present; and if, in addition to all these, the intellectual faculties remain perfect, until the disease arrives near its fatal termination.*

A narcotic poison, on the other hand, produces the following effects: Stupor, numbness, a great inclination to sleep, coldness and stiffness of the extremities, a cold sweat of a fetid or greasy nature, swelling of the neck and face, protrusion of the eye, with a haggard cast of countenance; thickening of the tongue, frequent vertigo, weakened eyesight, or objects presented to it in a fantastic manner; coma, delirium, general debility, palpitation of the heart, the pulse at first full and strong, but afterwards unequal and intermittent; paralysis of the lower extremities, retraction of the lips, general swelling of the body, and dilatation of the veins. At the conclusion of the disease, slight convulsions and pain are sometimes present.†

If we pursue the arrangement proposed above, we shall find that the narcotico-acrid poisons are distinguished by a combination of several of the above symptoms. They are, agitation, pain, acute cries, sometimes stupor and convulsive motions of the muscles of the face, jaws, and extremities; vertigo, and occasionally extreme stiffness of the limbs, and contraction of the muscles of the thorax; the eyes red and starting from their sockets; the pupils frequently dilated; insensibility to external

* Foderé, vol. iv. p. 190. Orfila's Toxicology, vol. i. p. 15; vol. ii. pp. 98, 514. "In general," says the last author, "the patient preserves the use of his intellectual faculties during the first periods; but a short time before death, he falls into a state of great insensibility and immobility, and is agitated by convulsive movements." He also mentions purple spots over the body, and a miliary eruption, as occasional symptoms of this class.

† Foderé, vol. iv. p. 190; Orfila's Toxicology, vol. ii. pp. 170, 515.

impressions; mouth full of foam; tongue and gums livid; nausea, vomiting, frequent stools. Often these symptoms attack in paroxysms, and the patient is left comparatively easy for a few moments.*

It may appear easy, after this enumeration, to distinguish the nature of the poison that has been taken; but in practice it is, notwithstanding, very difficult. There are substances, very distinct in their characters, which produce similar effects, as, for example, cantharides, acrid vegetable substances, and caustic minerals. All these belong to the class of irritants, and generally exhibit similar symptoms. The difficulty is increased, when it is recollected that ordinary and innoxious substances, so far as concerns their poisonous nature, sometimes cause the most alarming symptoms. Foderé observes that he has seen a roasted chestnut produce all the symptoms of poison, until a dose of tartar emetic dispelled its influence.†

On the other hand, a variety is frequently observed in the symptoms excited by the same poison on different individuals. Many causes may conduce to this, such as the mode in which it is exhibited: poison given in the liquid form is generally more rapid and marked in its effects than when it is exhibited in the solid state; and the substances previously or subsequently taken may also modify the symptoms. Instances of this variety are to be found in all authors on toxicology. Marc produced salivation in a dog, by giving him a large dose of opium; while sleep, the common consequence, was wanting.‡ So also Morgagni relates of a female, aged sixty, who had eaten a paste compound of milk and arsenic, which had been prepared for rats. She died in twelve hours after, but without having suffered any severe pains or convulsions. On dissection, however, the stomach was found eroded.§

I apprehend that the circumstances of the patient's vomiting or not vomiting, has the greatest influence on the course and variety of the symptoms. This is a subject to which I

* Orfila's *Toxicology*, vol. ii. pp. 367, 516.

† I shall notice this point more particularly at the conclusion of the section.

‡ Foderé, vol. iv. p. 195.

§ Morgagni, vol. ii. epist. 59, p. 366.

shall have frequent occasion hereafter to refer, but it may be remarked at present, that there are many persons who vomit very readily, while in others the act is very difficult, and almost causes convulsions. In the former case, the poison may be rejected before it has time to produce injurious effects, while in the latter, death will be the inevitable consequence. And again, the poison, from the quantity taken, or for some other reason, may itself produce vomiting, and thus prevent the fatal termination. Dr. Petit, of Lyons, relates of a person who survived after taking half an ounce of arsenic, and he attributes this to the violent vomiting that ensued. Deschamps gives an account of a female who recovered after taking two drachms of tartar emetic, which was followed by vomiting; while another, who by buying small quantities from different apothecaries, had obtained eleven grains of the same salt, died from using it.* It is probable that large doses produce their effects early and violently, and the stomach endeavors to reject them as soon as perceived; while small ones seem to have time to act not only on the system generally, but also on the structure of parts.

A minute and accurate notice of symptoms is hence worthy of every attention, but it only forms the commencement of the inquiry in cases of supposed poisoning.

It is the further duty of the physician to examine every article of a suspicious nature, such as phials, boxes, or papers containing powders. These should be carefully put aside with-

* A still more striking case was mentioned in a Boston paper of the month of February, 1817. A man named George Beals, aged twenty-one, and residing at Springfield, Mass., with an intent to destroy himself, swallowed at one draught one ounce and a half of arsenic, immediately after having eaten a hearty supper of beefsteaks. He was seized instantly with violent vomiting, and was subsequently affected with spasms, but was restored to his usual health in three or four days. In about a month after, he destroyed himself by hanging.

Dr. Shipman (*American Journal Med. Sciences*, N. S., vol. vi. p. 520,) gives a similar instance of an insane person taking a teaspoonful on a hearty meal. Vomiting followed, and this was succeeded by diarrhœa. After about a week, he was seized with severe pain of the legs and arms, and partial paralysis of them. *The insanity was cured*, and the paralysis was gradually relieved.

out remark. If the patient preserve his senses, we may obtain much necessary information from him, and possibly may also procure the remainder of the drink or substance that he has not completely taken. If this be impracticable, the matter vomited should be preserved, as also the linen or sponges used to collect the fluid which may have been deposited on the floor of the chamber, and a sufficient quantity should be sealed up and reserved for the inspection of a competent chemist.

For a proper analysis of the matter vomited, of the matter found in suspected repositories, or the matter found in the stomach or intestines, or both, after death, the following preliminary directions require attention: Never make any experiments on the suspected substance without repeating them on ingredients that are deemed analogous, and in which the quantity of poisonous matter is ascertained. For this purpose, several solutions should be made of substances which it is supposed may probably resemble the poison given, and, from the result, a comparison can be instituted. Again, the analysis should never be commenced until the tests are all prepared, and their accuracy determined. The order of proceeding should be previously laid down in the mind of the operator; and when ready, he should perform the experiments at one time. The risk of losing a part of the suspected substance, from employing inconclusive experiments, is thus avoided. Thirdly, if the quantity of matter received be sufficient, it should be divided into small portions, so that the various tests can be applied to each; but if there be only a very small quantity, the symptoms should be carefully considered, together with the indications they present, and an opinion should be formed as to the poison which most probably has caused the present disease. The tests applicable to it should then be employed. In pursuing this examination, it is of little importance, comparatively speaking, whether a decisive opinion can be formed as to the *quantity* administered: it is sufficient to prove the *nature* and *quality* of the substance.*

* I have omitted a very important direction, and am reminded of its necessity by a case that lately occurred in this vicinity, as well as by the remarks

Chemistry can thus lend its aid in detecting mineral substances, but it often fails in ascertaining the nature of a vegetable poison. Of late years, however, great advances have been made even in this department, as will be seen more particularly when noticing opium, hydrocyanic acid, etc. But even in cases where the powers of analysis are at fault, some approach to the actual truth may be made by a careful examination of the contents of the alimentary canal. Grains or berries, or the ligneous parts of plants have thus been detected.

The kitchen utensils should always be noticed, since it may happen that a copper vessel, badly tinned, is the sole cause of these violent effects: and we should also remember that the green color which is frequently observed in the matter vomited may be owing to vitiated bile, as well as to a mineral or vegetable poison.

It is an ancient direction that part of the suspected substance should be given to some animal, in order to test its injurious nature. But the uncertainty of this proof has been shown in a former page, where it was mentioned that some articles poisonous to man are innoxious to animals; and it is therefore a point of considerable interest to ascertain on which of them it is most likely to produce similar effects. Physiologists generally recommend a dog as the subject; and Orfila says it should be a small, robust one, that is fasting. The suspected substance should not be put in his food, as is the ordinary practice, nor, indeed, should he be allowed to swallow it. This would produce the hazard of losing the whole by vomiting; and he, hence, advises that the œsophagus should be detached and perforated with a small hole; into this a glass funnel is to be introduced and the liquid poured through it into the stomach; the œsophagus is then tied below the opening. If the substance be solid, it should be put into a small paper cone, in order that it may be pushed down into the stomach through the opening. This, he adds, is the only

of Mr. Taylor, (*Med. Jurisprudence*, p. 13.) Never leave the vessel containing the suspected fluid in an exposed situation. Keep it under lock and key; and if interrupted in the course of your experiments, restore it to such a place, that you can positively affirm that no one could have meddled with it.

method by which vomiting can be prevented, and the suspected substance exhibit its true character.* The testimony to be derived from this proof of poisoning is, however, barely *presumptive*. The poisonous substance may be decomposed in the stomach of the patient by food or antidotes; it may have been rejected by vomiting, or it may have been absorbed so as to leave only a minute quantity in the intestinal canal; in all these cases the animal will probably escape uninjured. "Experiments of this kind, separately considered, possess no value, only as they present a positive result, that is to say, death: but, we repeat again, they ought not to be regarded, even when well made, except as a secondary means, proper for corroborating the conclusions drawn from chemical analysis, symptoms, and lesions of texture."†

While, therefore, such investigations are not to be totally discouraged, it is proper to suggest that in many, indeed in most instances, the suspected matter found is not sufficient to warrant the medical examiner in employing it for this purpose. He will generally have the alternative presented of omitting all other experiments if he makes these. Besides, as has been conclusively remarked by Professor Christison, "if the quantity of poison in the suspected substance is great enough to affect one of the perfect animals, it may be recognized to a certainty by its physical or chemical properties."‡

It must also be recollected, in connection with the circumstance under notice, that the human fluids, and particularly the *bile*, may, from disease, acquire such an acrimony as to be fatal to animals. Morgagni relates a remarkable instance of this kind. A child died of tertian fever, after having suffered

* Orfila's Toxicology, vol. ii. p. 532. It has been objected to this mode of experimenting that the operation on the œsophagus will destroy life, or produce alterations of texture; but our author shows, by numerous examples, that the ligature on this part in dogs constantly produces, during the two first days, nothing more than a slight fever and a little dejection, which is incapable of destroying them in so short a time; and also that if animals be killed when in this state, no lesions will be discovered on dissection. If poisons, on the contrary, be introduced through the opening, their effects will be early manifested. (Vol. ii. p. 482.)

† Orfila's Toxicology, vol. ii. p. 535.

‡ Christison, p. 62.

violent convulsion. On dissection, the stomach was found to contain green bile, which tinged the scalpel a violet color. Having dipped the point of his instrument in the bile, he wounded two pigeons, who expired almost instantly in violent convulsions; and some of it, mixed with bread, was given to a cock, who also expired in a short time.*

Until now, I have considered the subject of poisoning persons in a state of health. I may add, that this is often attempted on individuals who are ill, and the difficulty of distinguishing the symptoms of disease from those of poison is proportionably increased. It may be said that the disease has taken a sudden turn; that the medicines used have been prejudicial, and that present appearances are a convulsive or final effort of the system. In such cases, attention to the following circumstances is required:—

1. The sudden occurrence of symptoms which do not usually accompany the disease under which the patient labors. Thus, we should feel suspicious if, in an ordinary case, nausea, vomiting, hiccough, fainting, cold sweats, with bloody stools, should suddenly and rapidly follow each other; or, again, if stertor, delirium, or insanity should supervene on a case of common disease.

2. Moral evidence. This is to be attended to in all cases, but more particularly under the circumstances now indicated. The physician should never allow these to prejudice his mind, but he should never neglect noticing them; and I take this early occasion to say, that the physician is, of all persons, the best judge concerning them. Let him ascertain whether an enmity does not exist between the sick person and some one who attends or visits him; if so, inquire whether any poisonous substances have lately been purchased; whether these are still in the house; whether the alarming symptoms came on immediately after taking a drink, or any other substance of an innocent nature; and particularly, ascertain whether anything has been given without the orders of the physician, or by a person ignorant of medicaments.

Inquire, also, as to any suspicious conduct after the patient's

* Morgagni, vol. ii. epist. 59, p. 396.

death, such as hastening the funeral, preventing the inspection of the body, and giving a false account of the previous illness. In many cases, unfortunately, the crime of seduction is followed by attempts to destroy life; and hence, if a female has been poisoned, the investigation should extend to the decision of the fact of pregnancy.*

In illustration of these remarks, I will only quote at present, two cases; one comparatively ancient, and the other of late occurrence. When noticing individual poisons, numerous others must necessarily be mentioned, in which the moral evidence has thrown great light on their respective intricacies:—

An individual aged fifty-six years, and subject to flatulence, took a bowl of chocolate and milk previous to starting on a journey. It was prepared by his daughter. He had advanced a very short distance when he was seized with nausea, vomiting, and other severe symptoms, which obliged him to return home, and his death followed in nine hours after taking the chocolate. His body was not inflated; his visage was natural, but the nails were blue; and on his shoulders and breast were spots of the same color. This disease was considered cholera morbus; but Hoffman, from whom the narrative is taken, believed it to be the effect of arsenic rather than cholera, and for the following reasons: The symptoms which followed the use of the drink, such as copious vomiting, accompanied with a cadaverous paleness of the face, coldness of the extremities, great prostration of strength, poignant lancinating pain in the intestines, and the cessation of arterial action, and convulsions, all succeeded each other with greater rapidity than is observed in ordinary cholera morbus. Again, the daughter was at enmity with the father, who had punished her for living with her valet; and it was also known that she had previously purchased arsenic.†

“William Muir was tried and condemned at Glasgow, in 1812, for poisoning his wife. In the course of the day on which she was taken ill, she was visited by a farmer of the neighborhood,

* Christison, p. 71.

† F. Hoffman's *Opera Omnia*, vol. iii. sec. 2, chap. viii. p. 170.

who had studied physic a little in his youth. He learned from her that she had breakfasted on porridge a short time before she felt herself ill, and that she suspected the porridge to have been poisoned. He immediately procured the wooden bowl in which the cottagers of Scotland keep the portion of meal used each time for making the porridge, and finding in it some meal, with shining particles interspersed, he wrapped a sample in paper, and took the proper measures for preserving its identity. He then also secured a sample from the family store in a barrel. The two parcels were produced by him on the trial, and from experiments made in court, the late Dr. Cleghorn was enabled to declare that the meal from the bowl contained arsenic, and that the meal from the barrel did not. These facts, besides proving that the woman had, next to a certainty, taken arsenic in the porridge, likewise, in conjunction with other slight moral circumstances, established that the poison had been mixed with the meal in the house, and on the morning when the deceased took ill, before any stranger entered the house.”*

The subject of what have been called slow poisons deserves a passing notice, although it must be confessed that this is so closely connected with popular superstition that it is almost impossible to separate truth from falsehood. In Italy, for example, it was formerly said that poisons were invented to destroy life at any stated period, from a few hours to a year.†

* Christison, p. 72. The case was communicated by Professor Alison.

† We are indebted to Professor Beckmann for a very elaborate article on this subject, in which he has concentrated nearly all that is known concerning *secret poisoning*. Of this, I shall present an abstract, aided with some facts from other sources. He considers it unquestionable, that the ancients were acquainted with such a kind of poison, and thinks it may be proved from the testimony of Plutarch, Quintilian, and other respectable authors. The former states that a slow poison, which occasioned heat, a cough, spitting of blood, a consumption, and a weakness of intellect, was administered to Aratus, of Sicyon. Theophrastus speaks of a poison prepared from aconite, which could be moderated in such a manner as to have effect in two or three months, or at the end of a year, or two years; and he also relates that Thrasyas had discovered a method of preparing from other plants a poison, which, given in small doses, occasioned an easy but certain death, without any pain, and which could be kept back for a long time without causing weakness or corruption. This last poison was much used at Rome, about two hundred years before the Christian era. At a later period, a female named Locusta was the

This, however, is a mere fiction, and it is now well understood that we know of no substance which will produce death at a

agent in preparing these poisons, and she destroyed in this way, at the instigation of Nero, Britannicus, the son of Agrippina.

The Carthagenians seem also to have been acquainted with the art of poisoning; and they are said, on the authority of Aulus Gellius, to have administered some to Regulus, the Roman general. Contemporary writers, however, it must be added, do not mention this.

The principal poisons known to the ancients were prepared from plants, and particularly aconite, hemlock, and poppy; or from animal substances, and among the latter none is more remarkable than that obtained from the sea-hare, (*Lepus marinus*, or *Aplysia depilans* of the *Systema Naturæ*.) With this, Titus is said to have been dispatched by Domitian. They do not seem to have been acquainted with the common mineral poisons.

In the year 1659, during the pontificate of Alexander VII., it was observed at Rome that many young married women became widows, and that many husbands died when they became disagreeable to their wives. The government used great vigilance to detect the poisoners, and suspicion at length fell upon a society of young wives, whose president appeared to be an old woman, who pretended to foretell future events, and who had often predicted very exactly the death of many persons. By means of a crafty female, their practices were detected, the whole society were arrested and put to the torture, and the old woman, whose name was Spara, and four others, were publicly hanged. This Spara was a Sicilian, and is said to have acquired her knowledge from Tofania at Palermo.

Tophania, or Tofania, was an infamous woman, who resided first at Palermo, and afterwards at Naples. She sold the poison, which from her acquired the name of *Aqua della Toffana*, (it was also called *Acquetta di Napoli*, or *Acquetta* alone;) but she distributed her preparations by way of charity to such wives as wished to have other husbands. From four to six drops were sufficient to destroy a man, and it was asserted that the dose could be so proportioned as to operate in a certain time. Labat says that Tofania distributed her poison in small glass phials, with this inscription, *Manna of St. Nicholas of Bari*, and ornamented with the image of the saint. She lived to a great age, but was at last dragged from a monastery, in which she had taken refuge, and put to the torture, when she confessed her crimes, and was strangled.

In no country, however, has the act of poisoning excited more attention than it did in France, about the year 1670. Margaret d'Aubray, wife of the Marquis de Brinvillier, was the principal agent in this horrible business. A needy adventurer, named Godin de Sainte Croix, had formed an acquaintance with the marquis during their campaigns in the Netherlands, and became at Paris a constant visitor at his house, where in a short time he found means to insinuate himself into the good graces of the marchioness. It was not long before the marquis died, not, however, until their joint fortune was nearly dissipated. Her conduct, in openly carrying on this amour, induced her father to have Sainte Croix arrested and sent to the Bastile. Here he got acquainted with an Italian of the name of Exili, from whom he learnt

determined epoch. But I shall have occasion in the next section, when stating the case of the late Prince Charles, of August-

the art of preparing poisons. After a year's imprisonment, Sainte Croix was released, when he flew to the marchioness, and instructed her in the art, in order that she might employ it in bettering the circumstances of both. She assumed the appearance of a nun, distributed food to the poor, nursed the sick in the Hôtel-Dieu, and tried the strength of her poisons, undetected, on these hapless wretches. She bribed one Chaussée, Sainte Croix's servant, to poison her own father, after introducing him into his service, and also her brother, and endeavored to poison her sister. A suspicion arose that they had been poisoned, and the bodies were opened, but no detection followed at this time. Their villainous practices were brought to light in the following manner: Sainte Croix, when preparing poison, was accustomed to wear a glass mask; but as this happened once to drop off by accident, he was suffocated, and found dead in his laboratory. Government caused the effects of this man, who had no family, to be examined, and a list of them made out. On searching them, there was found a small box, to which Sainte Croix had affixed a written request, that after his death it might be delivered to the Marchioness de Brinvillier, or in case she should not be living, that it might be burnt. It was found to contain a great abundance of poisons of every kind, with labels, on which their effects, proved by experiment on animals, were marked. The principal poison, however, was corrosive sublimate. When the marchioness heard of the death of her lover and instructor, she was desirous to have the casket, and endeavored to get possession of it by bribing the officers of justice; but as she failed in this, she quitted the kingdom. La Chaussée, however, continued at Paris, laid claim to the property of Sainte Croix, was seized and imprisoned, confessed more acts of villainy than was suspected, and was, in consequence, broken alive on the wheel, in 1673.

The marchioness fled to England, and from thence to Liege, where she took refuge in a convent. Desgrais, an officer of justice, was dispatched in pursuit of her, and having assumed the dress of an abbé, contrived to entice her from this privileged place. Among her effects at the convent there was found a confession, and a complete catalogue of all her crimes, in her own handwriting. She was taken to Paris, convicted, and, on the 16th of July, 1676, publicly beheaded, and afterwards burnt.

The practice of poisoning was not, however, suppressed by this execution, and it was asserted that confessions of a suspicious nature were constantly made to the priests. A court for watching, searching after, and punishing prisoners, was at length established in 1679, under the title of *Chambre de poison* or *Chambre ardente*. This was shortly used as a state engine against those who were obnoxious to the court, and the names of individuals of the first rank, both male and female, were prejudiced. Two females, La Vigoureux and La Voisin, were burnt alive by order of this court, in February, 1680. But it was abolished in the same year.

Professor Beckman relates the following, as communicated to him by Linnæus: "Charles XI., king of Sweden, having ruined several noble families

tenberg, to show that the idea of slow poison is still prevalent, even among the physicians of continental Europe.

by seizing on their property, and having after that made a journey to Torneo, he fell into a consumptive disorder, which no medicine could cure. One day he asked his physician, in a very earnest manner, what was the cause of his illness. The physician replied, 'Your majesty has been loaded with too many maledictions.' 'Yes,' returned the king, 'I wish to God that the reduction of the nobility's estates had not taken place, and that I had never undertaken a journey to Torneo.' After his death, his intestines were found to be full of small ulcers."

There has been great diversity of opinion as to the nature of these poisons. That prepared by Tofania appears to have been a clear insipid water; and the sale of aquafortis was for a long time forbidden in Rome, because it was considered the principal ingredient. This, however, is not probable. In Paris, the famous *poudre de succession* (also a secret poison) was at one time supposed to consist of diamond dust, pounded exceedingly fine; and at another, to contain sugar of lead, as the chief ingredient. Haller was of this last opinion. In the casket of Sainte Croix were found sublimate, opium, regulus of antimony, vitriol, and a large quantity of poison ready prepared, the principal ingredients of which the physicians were not able to distinguish. Garelli, physician of Charles VI., king of the Two Sicilies, at the time when Tofania was arrested wrote to the celebrated Hoffman that the *Aqua Tofania* was nothing else than crystallized arsenic dissolved in a large quantity of water by decoction, with the addition (but for what purpose he knew not) of the herb *cymbalaria* (probably the *Antirrhinum cymbalaria*.) And this information, he observes, was communicated to him by his imperial majesty himself, to whom the judicial procedure, confirmed by the confession of the criminal, was transmitted. But it was objected to this opinion that it differed from the ordinary effects of arsenic, in never betraying itself by any particular action on the human body.

The Abbé Gagliani, on the other hand, asserts that it was a mixture of opium and cantharides, and that the liquor obtained from its composition was as limpid as rock water, and without taste. Its effects are slow, and almost imperceptible. Beckmann appears to favor this idea, and suggests that a similar poison is used in the East under the name of *poust*, being water which had stood a night over the juice of poppies. It is given to princes whom it is wished to dispatch privately, and produces loss of strength and understanding, so that they die in the end, torpid and insensible.

Dr. Duncan, Jr., however, objects to the opinion of Gagliani, as perfectly inconsistent with the appearance and effects of the poison. The prevailing idea is that of Garelli.

Cellini, who lived during the sixteenth century, tells us in his Autobiography that poisoning was attempted on him with the diamond, (not because they deemed it noxious, but from the particles irritating the stomach,) and with corrosive sublimate. (Beckmann, vol. i. p. 54; Smith, p. 195; London

The only case in which we can admit the action of poisons as in any manner approaching that ascribed to the deleterious agents used in former times, is when minute portions of the irritant poisons have been administered from time to time; or when individuals, through their occupations and employments, are daily exposed to an atmosphere containing small quantities of them. In this way the effects of disease may be mistaken for poisoning, and vice versa. Their course often is gradually to cause irreparable injury to the digestive and lymphatic systems, and finally to destroy life. In such instances, great caution in the examination of symptoms is necessary, and an extended inquiry should be made as to the agents that possibly may induce them.

Poisons may also be administered to several persons at once, as at an entertainment, and the symptoms that follow be so various as to render the cause doubtful, were it not understood that such consequences are of frequent occurrence. I shall endeavor to illustrate this point by some cases:—

In the month of May, 1711, four individuals, viz., a priest, two females, (one of whom was his sister-in-law,) and another

Monthly Magazine, vol. xiv. p. 515; Metzger, pp. 386, 402; Supplement to Encyclopedia Britannica, art. *Aqua Tofania*, Dr. Duncan, Jr.)

"It is not because we know less," says Dr. Duncan, "but because we know a great deal more than our forefathers, that the art of secret poisoning seems to be lost." In Turkey, it would appear from Dr. Oppenheim's Narrative, that corrosive sublimate is often employed. (Medico-Chirurgical Review, vol. xxiii. p. 438.) Mr. Madden, (Travels, American edition, vol. i. pp. 33, 82,) however, says that the poison used is tasteless, and on that account imagines it to be arsenic. He saw eight cases while residing in Turkey, and in most of them death ensued within twelve, and in all, within forty-eight hours. "The terrible science of poisons," says Sismondi, "is the first branch of chemistry which is successfully cultivated by barbarous nations." (Fall of the Roman Empire, vol. i. p. 256.)

Secret poisoning has even penetrated into the forests of our own country. "The celebrated chief, *Black Bird*, of the Omahaws, gained great reputation as a medicine man; his adversaries fell rapidly before his potent spells. His medicine was arsenic, furnished him for this purpose by the villany of the traders." (Dr. James' Account of Major Long's Expedition, vol. i. p. 226.)

Those who are curious on the poisons of the ancients, I will refer to Adams on the ancient principles of toxicology, in Edinburgh Medical and Surgical Journal, vol. xxxiii. p. 315; and Sir Henry Hallford's essay on deaths of some illustrious persons of antiquity.

person, all in good health, and on a journey, stopped at an inn to dine. They proceeded on their journey after taking this meal; but in a short time the priest was seized with such violent pain as to oblige him to dismount from his horse. Copious evacuations by vomiting and stool succeeded, and his illness increased so rapidly that it was found necessary to take him back to Cesenne, the place where they had dined. A physician was called in, who, conceiving the complaint to be only an ordinary colic, treated it with fomentations, glysters, purgatives, and anodynes. During this time, one of the females was seized with severe pain and weakness, accompanied with copious evacuations. The fourth person of the party also complained of pain and weight on the stomach; but, notwithstanding this, the physician had no suspicion of poison, since the other female was in perfect health, and the landlord protested that there could have been nothing noxious in his dishes. On the next day they were all somewhat better, and were enabled to arrive at a place near where Morgagni resided, for whom they immediately sent. This great physician, having learnt the circumstances, immediately inquired whether there was not some dish on the table of which the female in good health had not eaten. He was answered in the affirmative, and it was ascertained to have been a large dish of rice, served up at first. He settled in his own mind that there were poisonous materials in this dish; but the difficulty was, why the priest, who had eaten the least, should have suffered the most, while the female who had eaten a larger quantity was not so ill; and finally, that the fourth person, who had eaten more than all the rest, had only some pain in his stomach. Was there not, said Morgagni, some cheese grated over this rice? They answered in the affirmative, and the priest, who had little or no appetite, ate scarcely anything but the cheese; the female ate both cheese and rice, while the other person ate the rice with scarcely any cheese. Then, said Morgagni, the state of the case is, that the cheese was prepared with arsenic to kill rats, and not having been laid away with sufficient care, it was served up for your rice, while you were hurrying the landlord for your dinner. This opinion was

verified by the confession of the landlord himself, who, learning that the patients were out of danger, avowed that such was the cause of the accident.

At a banquet, numerously attended, a dish was brought in during the dessert in which arsenic had been used instead of meal. Those of the guests who had eaten or drunk but little, died in a few hours; while those who had eaten considerably were saved by copious vomiting. Some lived for several years, and, when examined after death, *the cicatrices of large ulcers were found in their stomachs.*

In another instance, a boy two years old, and two adult females, partook of some soup in which arsenic was mixed. The boy took only two spoonfuls, but it was on an empty stomach; while the females, who had already eaten, took the remainder of it. They vomited copiously, and survived; while the other did not vomit, and died, and, on dissection, his stomach was found ulcerated.*

From these, and several other cases related by Morgagni and Hoffman, Foderé draws the following conclusions: 1. In such instances, the physician should enter into the most minute details concerning everything that has passed at the meal. Inquire whether every one ate from all the dishes, and in what quantity; what kind of meats were eaten, and what wines drunk. 2. That very different effects ensue from taking poison on an empty or on a full stomach; and hence Baccius, he says, recommends to those *who fear being poisoned at a banquet, first to eat and drink a considerable quantity.* This precaution was doubtless not an idle one in some of the capital cities of continental Europe, and one effect of it certainly is, that it protects the stomach to a certain degree from the activity of the poison, and also facilitates vomiting. The practice of mountebanks, who pretend to sell antidotes to arsenic, is said to be in conformity with this direction. They first fill the stomach with milk or oily fluids, and then swallow the arsenic in public. In secret, however, they shortly throw it up again,

* Foderé, vol. iv. pp. 242, 244. These cases are quoted from Morgagni, *de Causis et Sedibus Morborum*, epist. 59.

and sometimes it proves fatal when retained too long. 3. It may sometimes be necessary to inquire of what kind of dainties the poisoned persons were most fond, since murderers have sometimes taken advantage of a known partiality. 4. It is evidently no reason that a certain article of food or drink is not poisonous, because some individuals have taken it without inconvenience. We have already seen the difference between vomiting and not vomiting. The greater the quantity of poison taken, the more is there a hope of escaping; while those who feel no immediate ill effects are often the earliest victims. Both descriptions of persons should be examined, and the matter vomited should be analyzed, in order to detect the nature of the poison.*

It is a very difficult question to determine whether poisoning is the result of suicide or homicide. We can only form an opinion from moral considerations; and a notice of the following points is recommended by Foderé: The previous state of the mind of the deceased—whether he has been subject to delirium; also if he has not met with losses, has been disappointed in his hopes, or is suffering under disgrace. Also, whether any of the persons with whom he lived or associated had any interest in his death. The season of the year also deserves consideration. He observes, that suicides are most frequent during the period of the solstices and the equinoxes. We should also ascertain whether the patient, instead of complaining, remains quiet, seeks solitude, and refuses the aid of medical men and of medicines. Any kind of writing left by the individual, to express his last wishes, as it is the most common, so it is also the most certain, proof of self-destruction. But finding a part of the poison in the room or in his pockets, is evidently a very equivocal proof, since it may quite as easily be put there by others as by himself.†

* Foderé, vol. iv. pp. 240 to 248; Orfila's Toxicology, vol. ii. p. 548.

† Foderé, vol. iv. p. 248; Smith, p. 274. Metzger observes: "La seule présomption physique, (de suicide,) est la quantité considérable du poison englouti, dont le goût nauséabond eût certainement excité le vomissement, s'il eût été administré par une main étrangère. Les poisons végétaux entraînent presque toujours l'idée d'imprudence, et excluent conséquemment,

It may sometimes happen that a false accusation of poisoning is brought, and that great illness is pretended. In such instances, the complainer should be tested by the rules already laid down, and a long examination will scarcely ever be necessary in order to develop the deceit. I will state a single case in elucidation:—

“Samuel Whalley was indicted at the York spring assizes, England, in 1821, for maliciously administering arsenic to Martha King, who was pregnant by him. The female swore that the prisoner, after twice trying, but in vain, to prevail on her to take drugs for the purpose of procuring abortion, sent her a present of tarts, of which she ate one and a half; that in half an hour she was seized with symptoms of poisoning from some irritant poison, and that she continued ill for some time after. Mr. Thackrah, of Leeds, found arsenic in the tarts that remained untouched, and likewise in some matter that was vomited in his presence, after the administration of an emetic, as well as in other vomited matters which were preserved for him between his first and second visits. Her appearance, however, did not correspond with the complaint that she made of her sufferings; her pulse and tongue were natural, and, on careful investigation, the following inconsistencies were detected: 1. She said she felt a coppery taste in the act of eating the tarts, a taste which arsenic certainly does not possess. 2. From the quantity of arsenic in the tarts which remained, she could not have taken above ten grains; while, even after repeated attacks of vomiting, the alleged matter subsequently preserved contained nearly fifteen grains. 3. The matter first vomited contained only one grain, while the matter alleged to have been vomited subsequently contained fifteen grains. 4. The time at which these fifteen grains were alleged to have been vomited was not until between two or three hours after the symptoms began, in which case the symptoms would, before that time, have been, in all probability, violent. The prisoner was acquitted, and the prosecutor and another woman, who corroborated her deposition,

dans le plus grand nombre des cas, celle de suicide; l'opium seul est communément mis avec connoissance de cause en usage.” (Page 148.)

afterwards admitted that they had entered into a conspiracy to impute the crime to him, because he had deserted her, on finding that she was too intimate with other persons.*

[The length of time elapsing between the alleged administration of the poison and the occurrence of the symptoms may prove a valuable source of evidence. A woman accused her husband of an attempt to poison her, and handed to the authorities a vessel containing arsenic, and some food, which she stated had been prepared for her by the prisoner. The food was found, by analysis, to contain arsenic. The husband was immediately committed to prison. The wife left her bed, apparently quite well, and so remained for eight days, exhibiting no symptoms of poisoning. She was then seized with a fit of mania, and died the following day—nine days after she had accused her husband with administering poison in her food. On examination of the body, it was found that she died from the effects of arsenic, that poison having been found in large quantity in the alimentary canal, together with the usual morbid changes in the stomach and intestines. The medical witnesses affirmed that the arsenic could not have lain dormant eight days without producing any of its usual effects. The prisoner was discharged.†—S. S. J.]

I will conclude this section with a brief notice of such diseases and their symptoms as are most apt to be mistaken for the effects of poison. And first, of those that resemble the consequences of *irritating poisons*. Among them Dr. Christison enumerates the following: Distension and rupture of the stomach; rupture of the duodenum, biliary ducts, uterus, or other organs in the abdomen; the effects of drinking cold water; bilious vomiting and cholera; inflammation of the stomach; inflammation of the intestines; inflammation of the peritoneum, spontaneous perforation of the stomach; melæna and hæmatemesis; colic, iliac passion, and obstructed intestines.

Independent of all these, idiosyncrasy alone will produce

* Christison, p. 92; Edinburgh Med. and Surg. Journal, vol. xxix. p. 19. The credit of detecting the conspiracy in this case is due to Mr. Thackrah and Mr. Walker.

† Annales d'Hygiène, 1836, vol. ii. p. 391, cited by Taylor.

alarming effects, which may be mistaken for the consequences of deleterious agents. Some individuals have an antipathy for a particular article of diet, and in some instances the bare seeing of it, and in others the eating of it, produces the most alarming consequences. Cheese and various other articles have produced such effects. But the most striking cases of resemblance to the effects of poison probably occur in those who, after being long accustomed to a particular species of food, for the first time use another kind. The town of Martigues, in France, is almost altogether inhabited by fishermen, who have lived on fish since their infancy. Foderé, during the first year of his residence there, often prescribed meat-soups to his sick, but in every instance their administration was followed by violent nausea and vomiting. They confessed that it was the first time they had used any aliment prepared from meat.

Distension of the stomach from excessive gluttony may cause sudden death; and although it is immediately owing, in many instances, to congestive apoplexy, without any rupture of vessels, yet in some it would appear to be altogether independent of this. Thus Wildberg mentions of a corpulent gentleman who died suddenly fifteen minutes after dinner, and, as he had lived on bad terms with his wife, a suspicion arose that he had been poisoned. He fell asleep immediately after dinner, but in a few seconds awoke in great anguish, declared he was dying, and actually expired before the physician arrived. The stomach, on dissection, was found enormously distended with various articles of food, while the diaphragm was pushed high into the chest, from the great accumulation of contents. There was no particular congestion of the brain.* In these instances, as in many of the succeeding, though the symptoms be suspicious, the appearances on dissection will distinguish the cause.

Rupture of the stomach generally arises from over-distension with efforts to vomit; or there may be some chronic disease which, when a particular exciting cause operates, induces this dreadful termination. In a case at Paris, related by Lallemand, the coats of the body of the stomach were healthy, but

* Christison, p. 100.

the pylorus was indurated.* *Rupture of the duodenum* is referred to at page 56 of this volume.† Death followed in a few hours, after violent pain, vomiting, cold extremities, and failing pulse. On dissection, the mucous coat of the duodenum was found much inflamed, and four inches and a half from the pylorus was a lacerated hole. *Rupture of the biliary ducts, uterus, etc.*, from the violence and rapidity of their effects, may equally imitate the results of irritant poisons. A female in Scotland was supposed to be poisoned, in consequence of being suddenly seized at 2 P. M. with pain in the abdomen, vomiting, and purging, and general sinking, and dying at ten. On inquiry, however, it was proved that she had taken nothing since breakfast, at 8 A. M., and also that the pain commenced at the lower part of the abdomen. A Fallopian conception was seen, on examination, and, from the rupture of this, death was produced. Sudden death from *drinking cold water* has been already noticed in a previous part of this volume. It is highly probable that, in some cases where life is prolonged, acute gastritis occurs; and accordingly, after death, marks of inflammation will be discovered; but the appearances on dissection, as well as the phenomena in the more common instances, are sufficient to set us right as to the cause.

* A case of rupture of the stomach, with no apparent disease of the organ, is given in *Medical Gazette*, vol. ii. p. 182.

† The symptoms following ruptured bowel are death-like from the moment of the injury. They are quite unlike those of inflammation and of gangrene, and are indeed *sui generis*. The mind is clear but depressed, as if overwhelmed by the irreparable nature of the injury. The countenance is pale, and the features liny and drawn. The pulse is not immediately affected, but soon becomes quick, feeble, and irregular in its measure, intermitting, thready, and then no longer to be felt. The surface chills, but remains dry: there is a painful sense of dryness of the mouth and fauces, and frequent efforts to vomit. Pain, which commences at variable periods, but is never long delayed, is acute, unremitting, extending over the whole abdominal region, which becomes tense, and will not bear the slightest pressure. This produces great anxiety and restlessness, and frequent appeals for relief, and next for death. The peritoneal surface is reddened, but there is seldom any effusion of membranous or massive lymph agglutinating parts; only small deposits in tags and shreds roughening the surface, although the period of survival varies from twelve to six-and-thirty hours; the state of the canal perhaps determines this variation." (Benj. Travers, in *Medico-Chirurgical Transactions*, vol. xxiii.)

Of bilious vomiting and cholera it must be allowed that many of the symptoms are identical with those of irritant poisons; such as the burning pain in the stomach and bowels, incessant vomiting and purging, and the irritation about the throat and rectum, cramps, extinction of the voice, smallness of the pulse, coldness of the extremities, etc. It is natural that this should be so, since the disease is mainly the same in both instances. Yet there are some circumstances which may aid in discriminating. In cholera, the sense of acridity in the throat and œsophagus does not precede the vomiting; in poisoning, it frequently does. The patient, also, in the latter case, often dwells on it as the chief source of his sufferings, while this is seldom witnessed in cases of cholera. In cholera the vomiting is never bloody, according to Christison; at least it is rare; while in poisoning, from several of the active and more common agents, it is not unfrequent.* As to the rapidity of the effects of each, though, generally speaking, the common cholera morbus is far from being as soon fatal as poisons, yet there have been cases in this country where death has succeeded in a few hours. The malignant cholera often exceeds irritant agents in the celerity of its fatal results; but I submit whether its characters are not sufficiently marked to distinguish it from a case of poisoning. The appearance of the evacuations, the color and the expression of the countenance, and the appearance of the body, are quite peculiar, while the secondary symptoms, being either simple coma or typhoid fever, differ materially from those of irritant poisons.†

The season of the year, and the prevailing epidemics, are also worthy of consideration. In some cases of poisoning, where the symptoms greatly resembled cholera, and where this was urged in explanation, it appeared that death had

* *Cyclopedia of Practical Medicine*, vol. i. p. 381, art. *Cholera*, by Dr. Brown. See also a case of epidemic cholera, mistaken for poisoning, but in which the analysis by Orfila was decisive, in showing the absence of any poisonous substance. (*Annales d'Hygiène*, vol. ix. p. 405.)

† M. Tardieu exhibits the medico-legal relations of this subject in *Annales d'Hygiène*, 1854, vol. ii. p. 162.

Case of the Duc de Praslin, at Paris, 1847. (*Annales d'Hygiène*, 1847, vol. ii. p. 390.)

happened during midwinter, a season when, at least with us, common cholera is unknown.

Acute inflammation of the stomach is comparatively a very rare disease; and although *inflammations of the intestines and of the peritoneum* are more common, yet their course is usually more protracted, and their discriminating symptoms equally marked with those for which they might be mistaken. So also with other affections of the bowels that I have mentioned. *Melænia* and *hæmatemesis* are characterized by the purging and vomiting of pure or altered blood, but beyond this, they have hardly a symptom in common with irritant poisoning.*

Spontaneous perforation of the stomach I shall consider in the next section. The obscurity of its symptoms, and the consequent necessity of establishing the nature of the case by dissection, will authorize a notice of it in that place.

On a review of the above diseases, it will be seen that, although some of the leading symptoms in most are similar to those produced by poisoning, yet a careful observer may in a short time discover some points of difference. The accumulation of these constitutes the history of the particular disease, and it is evidently incomplete without a proper examination after death.

The principal disease, whose symptoms may be confounded with those of *narcotic poisoning*, is apoplexy. Among such as are common to each, are the more or less complete abolition of sense and motion, and the supervention of convulsions. Apoplexy has, however, some distinctive characters, which are thus enumerated by Dr. Christison: It usually has several premonitory symptoms; it attacks the old principally, although not exclusively; its subjects are generally corpulent and of full habit; it attacks very soon after a meal, and its symptoms begin abruptly. I need hardly say how inapplicable several of these distinctions are in cases of poisoning. Patients, also, cannot be roused from the profound sleep of apoplexy; they

* In the above remarks on diseases, I have followed Christison, pp. 100 to 116. For a case of peritonitis resembling poisoning, see *Medico-Chirurgical Review*, vol. iv. p. 970. Cholera morbus from the too free use of ices. Several cases of this occurred in 1826, in Paris, Lyons, and Rouen, and poisoning was suspected. (*Bulletin des Sciences Médicales*, vol. ix. p. 250.)

may, however, when shaken or loudly called, in instances of narcotism from opium, the most common of these poisons, until toward the fatal termination.*

Epilepsy has also some characters in common with the effects of narcotics, but the history of the case, its chronic nature, the peculiarity of its paroxysms, and their length, all serve to distinguish it.†

2. *Signs of poisons on the dead body.*

In many instances the medical examiner is not called until the stage now about to be considered. The illness may have been sudden and rapid; it may have been difficult to procure medical aid, and thus the opportunity has been lost of comparing the symptoms with the appearances found on dissection. If such be the case, he should be guided solely by the phenomena that present themselves during the inspection.

I cannot better introduce my remarks on this branch of the subject than by quoting two cases from Dr. Christison's *Treatise on Toxicology*. None better illustrate the necessity of medico-legal examination in its most extended sense. The first is one that recently occurred to Dr. Wildberg, of Rostock: He was desired to examine the body of a girl who died while her father was in the act of chastising her for stealing, and who was believed by all the by-standers, and by the father himself, to have died of the beating. Accordingly he found the marks of many stripes on the arms, shoulders, and back; and under some of the marks, blood was extravasated in considerable quantity. But these injuries, though severe, did not appear to him ade-

* For the celebrated case of M. Pralet, in which the medical evidence was examined by Orfila, vide *Annales d'Hygiène*, vol. xxvi. p. 399, vol. xxix. pp. 103, 104; Taylor on Poisons, p. 131.

† Christison, pp. 578 to 589. It would be well to ascertain the state of the kidneys in all medico-legal cases of death in a state of coma. From the researches of Drs. Bright, Christison, and Wilson, it appears that simple apoplexy is often connected with the granular disintegration of the kidneys. (Christison, 3d ed., p. 615.)

The discrimination of tetanic convulsions, produced by certain narcotic poisons, as strychnia, has become a subject of great importance in legal medicine. (See Taylor on Poisons, p. 135.)

quate to account for death. He therefore proceeded to examine the cavities; and on opening the stomach, he found it very much inflamed and lined with a white powder, which proved on analysis to be arsenic. It turned out, that on the theft being detected, the girl had taken arsenic for fear of her father's anger; that she vomited during the flogging, and died in slight convulsions.

Pyl is the reporter of the second case. A woman was found with a wound in the left side of the breast, but the hemorrhage, which never had been great, was soon suppressed. Notwithstanding, she died in a few hours. On dissection, it was found that the wound had penetrated the pericardium, but did not reach the heart; and although the fifth intercostal artery had been divided, hardly any blood was effused into the cavity of the chest. Coupling this fact with the trifling hemorrhage during life, and in the presence of vomiting and convulsions immediately before death, Pyl became satisfied that she had not died of the wound; and accordingly, the marks of corrosion in the mouth and throat, and of irritation in the stomach, with the subsequent discovery of the remains of some nitric acid in a glass in her room, proved that she had died of poison.*

In addition to the rules already laid down in a previous chapter, it is proper to observe, that the whole of the alimentary canal, from the mouth downward, must be particularly examined; and after opening the abdomen, the liver should be raised, so as to view its concave surface, the gall-bladder, and a portion of the stomach. The spleen, pancreas, and mesentery, should also be noticed. Ligatures are then to be applied to the different portions of the alimentary tube, in the manner directed at page 15 of this volume, and the parts included within them removed from the body. This precaution is absolutely necessary to prevent the loss of any fluids contained in the alimentary canal.

After being thus removed, it should be opened throughout its whole extent, and the fluids and solids contained in it should be collected in proper vessels. The whole internal surface must then be washed with distilled water, which must

* Christison, pp. 53, 54.

likewise be preserved. The lesions observed should be noted, and all the inflamed or gangrenous portions detached with a scalpel. If there be any perforations, the parts round the holes should be taken out, and the solid portions preserved in alcohol. And it is highly important in this case, previously to absorb with a sponge all the fluid contained in the abdomen, and afterwards to deposit it in proper receptacles for future analysis.*

This examination should be made in the presence of a magistrate, and every fact should be recorded by a secretary in the order of its notice.

The next subject of inquiry is, the class of poisons which the appearances on dissection seem to indicate. The irritant poisons generally produce inflammation of the first passages, and occasionally constrictions of the intestinal canal, perforations or preternatural softness of the interior coats. Gangrene and sphacelus are also enumerated as consequences, but they are certainly rare.

The inflammation varies as to extent and intensity. Sometimes it affects the mouth, œsophagus, and more particularly the stomach, and extends to the duodenum, while in others it reaches through the whole space of the digestive tube. Again, the membranes are sometimes of a clear-red color, without any trace of ulceration; sometimes of a cherry-red, with longitudinal or transverse patches of a blackish color, formed by extravasated blood between the coats. Ulcerations are observed in various parts, but particularly near the pylorus.

The effects of narcotic poisons are far from being marked, or even peculiar. It is a common, but mistaken idea, that they induce a rapid tendency to putrefaction; that the countenance is red, swollen, or livid; that the extremities are flexible; that the blood is in a fluid state, and effused in various parts, and that the stomach and intestines are touched with sphacelus without any inflammation. Some of these may, and do occasionally occur, but they are far from being invariable in their appearance. Orfila denies the correctness of several from his own experiments. He has frequently observed that

* Orfila's Toxicology, vol. i. p. 72; vol. ii. p. 519.

putrefaction was not advanced more than usual at twenty-four, or even thirty-six hours after death; that the limbs were as stiff as in those who had been poisoned by substances of another class, and that the blood was coagulated a short time after death. On dissection, no traces of inflammation were found by him in the digestive canal of animals killed by narcotics, and he attributes such appearances to the subsequent administration of substances capable of producing inflammation. The lungs, however, present almost constantly livid and even black spots, and their texture is more dense and less crepitating. The brain also often exhibits distention of its veins.*

Dr. Christison observes that the morbid appearances left by them on the dead body are commonly insignificant. Sometimes, however, the veins of the brain are much gorged with blood, and the ventricles and membranes contain serosity. The blood appears to be in some cases altered in its nature, but these changes are by no means invariable, and may not be at all remarked.†

As to the narcotico-acrid, it may be remarked that there are some which are capable of exciting severe inflammation, accompanied occasionally with ulceration, while others do not inflame. The lungs, blood, brain, and other organs present, in general, the same alterations as are induced by the narcotics.

The reader must not, however, suppose that the lesions now described are the invariable results of the respective kinds of poison; on the contrary, a great variety in this respect has been noticed. Thus, Marc, in a case of poisoning by arsenic, found the membranes of the stomach *thickened*, instead of *eroded*.‡ And what is still more extraordinary, there have been cases where the exhibition of acrid and corrosive poisons has left no marks of disease in the stomach or intestinal canal. Morgagni, Wepfer, and Brunner mention instances of this nature; and Sauvages speaks of a person who died suddenly after a violent epileptic fit, from swallowing fifteen berries of the sumach. Ten were ejected by vomiting, and the remaining five were found in the stomach after death. Notwith-

* Orfila's Toxicology, vol. ii. pp. 171, 522.

† Christison, p. 578.

‡ Marc, p. 66.

standing this, the stomach exhibited no marks of lesion, nor was any other part of the body diseased. Etmuller mentions the following remarkable occurrence: A young girl having taken arsenic, vomited considerably during the night, and in the morning was found dead. The skin was of a livid blue color, but no appearances of disease could be found on dissection. There was no inflammation or gangrene present, yet in the stomach a white powder was observed, which, on being thrown on the coals, gave out a thick smoke with an arsenical odor. Powders containing a similar substance were found in the house, part of which was given to a dog, with fatal effects, and on dissection the stomach was found extensively inflamed. It is conjectured by the reporter that the poison, having been taken on a full stomach, may have prevented its usual chemical action.*

It has been supposed in explanation of these anomalies, that such poisons as are given in the form of powder will more readily cause destructive effects on the stomach than those which are soluble. We are, however, not in possession of sufficient facts to explain satisfactorily the great variety that is occasionally observed; and experiments, so far as they have proceeded, do not permit us to assign that as the general cause.†

I will here suggest as a possible, much more than a probable occurrence, that the use of an innocent substance during life, may cause appearances of a suspicious nature on dissection. The following case from Foderé will tend to illustrate this remark: A person at Chalons sur Marne, was just recovering from a severe sickness, and during his convalescence took a gentle laxative, after the operation of which he suddenly died. He was supposed to have been poisoned through the negligence of the apothecary, and to ascertain this the body was opened. The stomach and œsophagus were found red, and in some places livid, and resembling gangrene. Here the investigation stopped, and the patient was looked upon as evidently poisoned. M. Varnier, a physician at Chalons, knowing the exactness and prudence of the apothecary, felt, however, strong doubts concerning the cause of death, on reflection determined that the

* Foderé vol. iv. pp. 272, 273.

† Orfila's Toxicology, vol. ii. p. 521.

convalescence had been only an insidious respite. But it was necessary to assign a reason for the color of the œsophagus and stomach, and having learned that the deceased had been in the habitual use of a strong infusion of red poppies (*coquelicots*) for some time, the idea struck him that this might be the cause. To ascertain the fact, he gave a similar infusion to a dog, and, on dissection, found that the organs above mentioned were precisely of the same color as on the body of the person supposed to be poisoned. So deep indeed was it, that it resisted repeated ablutions.*

The inference from this example is manifest—not to depend too much on a single phenomenon, in considering the question of poisoning, while at the same time it illustrates the necessity of inquiring into persons' food and medicaments.

In the general remarks on poisons, it was mentioned that they might be introduced into the system by means of injection, and I repeat it at this time, for the purpose of enforcing the direction of examining the whole intestinal canal, from the mouth to the anus. If the noxious substance be thrown up in this manner, it will, of course, be in vain to look always for its indications in the stomach or smaller intestines.

The wife of a receiver-general of taxes, in the department of Arreige, was attacked some years since (in 1807) with a slight illness, which rapidly terminated in a severe and fatal one. On dissection, the intestines were found in a state of high inflammation. A servant-girl was arrested on suspicion, and it appeared that she had mixed twenty-four grains of tartar emetic in the tisan or drink of her mistress, and afterwards had boiled an ounce of arsenic with the liquor prepared for an injection. Previous to her execution, she confessed that not finding the tartar emetic sufficiently active, she administered the arsenic.†

But there is a more difficult case, somewhat connected with this point, which deserves the most deliberate investigation. It is the atrocious villany of introducing a poisonous substance after death, with the view of accusing an innocent person of the crime. Such an act is said to have been committed in Sweden,

* Foderé, vol. iv. p. 282.

† Ibid., vol. iv. p. 266.

and it will readily occur, that if a corrosive substance be injected, it may produce a change sufficiently marked to lead the uninformed observer to the supposition that murder has been perpetrated.

So important a subject has not escaped the investigation of Orfila. He instituted experiments with corrosive substances on the dead bodies of men and dogs, and the result has established certain definite and fixed characters.* Several dogs were hung, and a short time after death a quantity of corrosive sublimate, in the form of powder, and in small fragments, was introduced into the rectum. On examination the mucous coat of the intestine, near the anus, exhibited several folds of a clear rose color, but immediately above them the rectum was of its natural color, so that there was *a line of demarkation perfectly established between the parts to which the sublimate had been applied and those which had not been in contact with it.* The same experiment, performed on a living dog, presented, on dissection, an intense redness, which extended eight inches, *gradually* diminishing in intensity, and left no distinct line of demarkation. Similar effects were produced with arsenic. Verdigris, however, left no trace of demarkation or ulceration on the rectum of the dead dog, while it corroded the living parts. The sulphuric and nitric acids produced no other effect than their chemical one, and the lesions that indicate reaction in the system, such as inflammation and redness, were absent. Dr. Tartra found that he could produce on the dead, as well as on the living, that yellow or orange color, which is the characteristic of nitric acid. The stomach was rendered rotten by it, but in all his experiments on the dead, the striking distinction was wanting, viz., the presence of more or less inflammation. It could only commence on the living body. Lastly, Orfila ascertained that when these poisons were introduced into the alimentary canal, twenty-four hours after death, they no longer excited redness or inflammation, because life is entirely destroyed in the capil-

* He did not deem it necessary to experiment with the narcotics or narcotico-acrid, as the former do not produce any local lesion after death, and the latter only cause a slight degree of it.

lary vessels. It is only when they are applied an hour or two after death, that the inflammatory phenomena, accompanied *with the line of demarkation*, are capable of occurring.*

As to slow poisons, in the sense already applied to that name, we may remark that their peculiarities are very difficult to be distinguished. Foderé enumerates a long list of appearances, such as obstruction of the lymphatics, emptiness of the blood-vessels, a contraction and shriveling of the viscera, and marasmus;† but later and more minute observers contradict these.‡

Prince Charles of Augustenburg, Crown Prince of Sweden, and the predecessor of Bernadotte in that station, fell dead from his horse on the 22d of May, 1810, while reviewing troops in Scania. His death during that stormy period of public affairs excited great attention, and an opinion soon spread abroad that he had been poisoned. The king ordered a judicial investigation, and it appeared that Dr. Rossi, the physician of the late prince, had, without any directions, proceeded to inspect the body twenty-four hours after death; that he had performed this operation with great negligence, omitting many things which the law prescribed, which the assisting physicians proposed, and which were essential to render it satisfactory; and finally, that the coats of the stomach, instead of being preserved and submitted to chemical analysis, were, according to his own acknowledgment, thrown away. The royal tribunal adjudged him to be deprived of his appointment, and to be banished from the kingdom. This decision would not, of course, diminish the suspicion already excited; and among other physicians who were consulted on the case, M. Lodin, Professor of Medicine at Lynkoping, presented two memoirs, in which he stated it as his opinion that a *slow poison* of a vegetable nature, and probably analogous to the *aqua tofana*, had been administered to the prince, and that this had caused the apoplectic fit. His reasons were: 1. That the prince had always enjoyed good health previous to his arrival in Sweden, and, indeed, had not been ill until after eating a cold pie at an inn in Illaby. He

* Orfila's Toxicology, vol. ii. pp. 535 to 547; Foderé, vol. iv. p. 285.

† Foderé, vol. iv. p. 268.

‡ Orfila's Toxicology, vol. i. p. 477.

was shortly after seized with violent vomiting, while the rest of the company experienced no ill effects. 2. The prince was naturally very temperate. 3. Ever since his arrival in Sweden he had experienced a loss of appetite, with colic and diarrhoea. 4. That on dissection, the spleen was found of a black color, and in a state of decomposition, and the liver indurated and dark-colored, while during life he had experienced no symptoms corresponding to these appearances. Dr. Lodin confessed, however, that he was unacquainted with the effects that indicate the administration of such slow poison, but thought that the previous symptoms were such as might be expected from it.

For the credit of the profession, this conjectural opinion met with decided reprobation from other medical men. It appeared that the prince had, for several days previous, been subject to giddiness and pain in the head, and that all the symptoms were readily referable to a simple case of apoplexy; that on the day of his death he had not taken anything after he breakfasted; and an *interval of nearly four hours elapsed after that till he fell from his horse*. The appearances on dissection also showed marks of long antecedent disease.*

In the conclusion of the last section, several diseases were mentioned that might be mistaken for the effects of poison. I shall now indicate certain circumstances which, if not properly understood, may lead to error in examining the dead body.

1. *The vascularity or redness of the human stomach after death* from natural causes should not be confounded with the effects of poisoning. We are indebted to Dr. Yelloly for first calling the attention of physicians to this appearance, and also to the difficulty of discriminating it from the effects of irritation. This distinguished physician examined the stomachs of twenty individuals, among which number were five criminals who were hanged, and in whom therefore the appearances of health were likely to be found. Not one of the whole number had any affection of the stomach while living. In all he observed a highly vascular state of the villous coat of the stomach in particular parts (as about the pylorus and cardia), with but

* Foderé, vol. iii. p. 20, vol. iv. p. 236; Christison, p. 46; Edinburgh Annual Register, vol. iii. p. 345.

two exceptions; in one of these no vascularity was observed, and in the other it was obscure. In the five executed criminals the vascularity amounted to a red or crimson hue. These appearances were distinct for a short time only after death, being most marked on the first day, and soon after, but at irregular periods becoming more obscure. Dr. Yelloly infers from these dissections "that in the villous coat of the stomach appearances of vascular fullness, whether florid or dark-colored, in distinct vessels or in extravasations of different sizes, are not to be regarded as unequivocal marks of disease; they occur in every variety of degree and character, under every circumstance of previous indisposition, and in situations where the most healthy aspect of an organ might be fairly inferred; they are found in every part of the stomach, but principally in the posterior part of the great end, and in the lesser curvature; and they cover spaces of various extent, but are generally well defined, and terminate abruptly."*

MM. Rigot and Trousseau, and M. Billard, have pursued the investigation of this subject to a greater extent. The former have proved by experiment that various kinds of pseudo-morbid redness may be formed which cannot be distinguished from the parallel varieties caused by inflammation; that these appearances are produced after death, and not until three, five, or eight hours after it; that they are to be found chiefly in the most depending parts of the stomach and turns of the intes-

* See Dr. Yelloly's paper, "On the vascular appearance in the human stomach, which is frequently mistaken for inflammation of that organ," in the *Medico-Chirurgical Transactions*, vol. iv. p. 371; also, *Edinburgh Med. and Surgical Journal*, vol. x. p. 236. Dr. Yelloly deems the vascularity in question entirely venous, though its color is sometimes florid and sometimes of a dark red, and that it depends on a power capable of being exercised on the artery itself, at the close of life, which carries on the blood to the veins, after the further supply of fresh blood from the heart is stopped. The stellated form of vessels, under which the vascularity usually appears, may be imitated by injection of the veins, or by forcing back with the finger the blood from the larger branches of veins into the smaller. In a communication to the same society (*Medico-Chirurgical Transactions*, vol. xx. p. 1) Dr. Yelloly reaffirms his opinions, and extends them to the appearances observed in the spinal marrow. He asserts that many of these changes are owing to the loss of vitality, and that the vascularity in question is entirely venous. To prove inflammation there must have been symptoms of it during life.

tines; and that after they have been formed, they may be made to shift their place and appear where the membrane was previously healthy, by simply altering the position of the gut. M. Billard has described this redness through all its varied forms, and corroborates the fact of the extreme difficulty of distinguishing between the morbid and pseudo-morbid redness of the inner coat of the alimentary canal.*

"That there may be no deception," says Professor Carswell, "with regard to the degree of the red color and vascularity of parts after death, it is also of great importance that they be examined immediately after they are exposed to view, as under the influence of the air, those which are almost pale, become reddened, or if slightly red, become much redder in the course of a very few hours. From this cause, membranes in which few or no blood-vessels are at first observed by the naked eye, become vascular and venous, and mechanical congestion assumes the appearance of inflammation.†

In connection with this, it is proper to caution the examiner not to mistake the discoloration that is produced on the coats of the stomach and intestines, after some time, from the proximity of the liver or spleen. This may be of a reddish, brownish, yellowish, or greenish tint. Let the case also be remembered, which I have just quoted, of colored fluids actually dyeing these parts.

Dr. Christison is disposed to consider an appearance, mentioned under the head of irritant poisons, as always the result of irritation, if not the irritation from poison only. "It is the

* Christison, p. 119. See also the reference at page 20 of this volume; also, a copious analysis of Billard, on the healthy state of the alimentary mucous membrane, in *Edinburgh Med. and Surgical Journal*, vol. xxviii. p. 164. Dr. Hodgkin, on the effects of acrid poisons, in *Report of the fifth meeting of the British Association*, p. 211.

† Fasciculus 12. Inflammation. Professor Carswell also remarks that the redness by imbibition or transudation is a mere dye, almost scarlet red, and generally limited to the lining membrane, without any perceptible change of the coats of the vessels. It can be removed by ablution or pressure. The redness from inflammation, on the other hand, is of a dull, rather pink tint, extending more or less to the other coats, accompanied with a fine capillary injection of the subjacent cellular tissue, and a disorder of the other subjacent parts.

effusion under the villous coat of the stomach, and incorporation with its substance of dark-brownish, or, as it were, charred blood, which is thus altered either by the chemical action of the poison or by a vital process." Great care should, hence, be used in searching for this, and it should not be confounded with the phenomena of redness now explained. So also we should particularly notice whether any effusion of coagulable lymph be present. This is also a sign of inflammation.*

2. *Ulcers or perforations of the stomach and intestines* occur-

* In connection with the notice of the above phenomenon, the following remarks on the *healthy appearance of the internal surface of the stomach* may be found of use: "Very various are the accounts given by different authors who have written upon this subject, of the natural and healthy color of the mucous membrane. It has been described as being white, grayish-white, grayish, reddish, grayish approaching to yellow and red, straw-colored, etc. Billard, in whose opinion Dr. Hodgkin is inclined to place most confidence, states it to be a dead milky-white. According to Buisson and Bichat, the color is of a deep-red, and Sabatier and Habicot describe it as of a reddish-purple and deep-purple. Gavard, Boyer, Soemmering, Chaussier, and Adelon, make it of variable shades between red and gray. Rousseau, who derived his opinion from the examination of the bodies of criminals dying by the hands of the executioner, (by the guillotine, we presume,) states that the color of the gastro-intestinal canal is white, or white faintly tinged with red. Dr. Yelloly states that in various opportunities which he had of examining the human stomach soon after death, in such parts of it as were free from vascularity it had usually a light straw-colored tinge, but gives it as his opinion, that from the analogy of the mucous covering of the mouth and fauces, and of the urethra, it is probable that when circulation is going on in the stomach its inner surface is of a pale-red hue, arising from vessels so minute as to give a uniform color, without any appearance of distinct vascularity. We are ourselves rather disposed to agree with M. Hippolyte Cloquet, who describes the usual appearance of the membrane as being of a reddish-white and mottled, (*comme marbrée*,) but we must observe that this diversity of opinion as to a fact so evident to the senses, could only have arisen from the varying appearances of the membrane presented to the several observers under different circumstances of disease, or from the effects of certain physical agents acting during the last moments of life. The manner of death would appear to exert considerable influence; the presence of aliment recently taken into the stomach causes a decided red tinge throughout the membrane; extremes of cold and heat, according to Beaupré, are also productive of a like effect in the mucous membranes generally, and the stomach has been observed to take a decided tinge from various medicines administered shortly before death." (British and Foreign Medical Review, vol. xi. p. 412.)

ring after death, or as the result of disease, have been mistaken for the effects of irritant poisons. In the commencement of our knowledge respecting them, that phenomenon, which is now styled a *gelatinizing of the coats*, particularly attracted attention. It has been otherwise called *digestion of the stomach after death*. Its nature was first developed by the illustrious John Hunter. He found repeatedly, on dissection, that the great end of the stomach was digested, and holes made in it. "To be sensible of this effect," says he, "nothing more is necessary than to compare the inner surface of the great end of the stomach with any other part of the inner surface; what is sound will appear soft, spongy, and granulated, and without distinct blood-vessels, opaque and thick; while the other will appear thin, smooth, and more transparent, and the vessels will be seen ramifying in its substance, and upon squeezing the blood which they contain, from the larger branches into the smaller, it will be found to pass out at the digested ends of the vessels, and appear like drops on the inner surface." Again, he observes, "that when the stomach is actually perforated, the edges of this opening appear to be half dissolved, very much like to that kind of dissolution which fleshy parts undergo when half dissolved in a living stomach, or when dissolved by a caustic alkali, viz., pulpy, tender, and ragged." Lastly, he remarks that he found these appearances more frequent in those who had died a violent death. He relates two cases of this kind, in which the persons had died shortly after having their skulls fractured, and a third one, where a man had been hung.

The cause of this appearance of the stomach is supposed by Mr. Hunter to be the action of the gastric juice on the coats of the stomach. And the reason why this effect is not produced during life is, according to him, the constant resistance of the vital principle to its action. He also observes that the power of the gastric juice is not confined to the stomach alone, since he has often noticed that after it has dissolved the stomach in its usual place, the contents of the stomach would come in contact with the spleen and diaphragm, and partly dissolve the adjacent side of the spleen and diaphragm, so that the contents of the stomach were

found in the cavity of the thorax, and had even affected the lungs in a small degree.*

Dr. Baillie's description of this phenomenon is as follows: "In looking upon the coats of the stomach at its great end, a small portion of them frequently appears to be thinner, more transparent, and feels somewhat more pulpy than is usual; but these appearances are seldom very strongly marked. They arise from the action of the gastric juice resting on that part of the stomach in greater quantity than anywhere else, and dissolving a small portion of its coats. This is, therefore, not to be considered as a consequence of a disease, but as a natural effect arising from the action of the gastric juice, and the state of the stomach after death. When the gastric juice has been in considerable quantity, and of an active nature, the stomach has been dissolved quite through its substance at the great end, and its contents have been effused into the general cavity of the abdomen. In such cases, the neighboring viscera are also partially dissolved. The instances, however, of so powerful a solution are rare, and have almost only occurred in persons who, while in good health had died suddenly from accident."†

We shall, however, be mistaken, if we suppose that this occurrence is confined to such as expire suddenly and in apparent health. Cases in great number have accumulated, of its being found in persons dying from diseases; and many French pathologists, indeed, are of opinion that it is always a morbid process, constituting a peculiar complaint. It has, however, been found present in persons dead from very opposite ones, and in which there did not exist during life a single sign of disorder in the stomach.

Perforations of the stomach, intestines, and sometimes the gullet,‡ have also frequently been noticed as the result of

* Hunter, in *Philosophical Transactions*, vol. lxii.

† Baillie's *Morbid Anatomy*, American edition, p. 75.

‡ Mr. T. W. King relates several cases of digestive solution of the œsophagus, owing, in his opinion, to the agency of the gastric juice, which may have been regurgitated about the period of the cessation of life. In some of these, the stomach was not digested. (*Guy's Hospital Reports*, vol. vii. p. 139; *ibid.*, N. S., vol. i. p. 113.)

In the latter communication, Mr. King remarks, "that considering the ex-

ulceration or scirrhus. In some melancholy instances, rupture takes place, and the sufferings of the patient previous to death are of the most severe nature.*

The application of this subject, in legal medicine, is the distinction between the perforation induced by corrosive poisons and those which, as we have stated, are the result of other agents. The following are the views of Chaussier:—

“The causes which produce erosions and perforations of the stomach are of two kinds: first, the destruction of a scirrhus tumor, the progress of a cancerous ulcer; second, a morbid action of erosion, of ulceration which has commenced spontaneously at some point of the mucous lining of the stomach. The perforations of the first kind are not rare, but cannot easily be confounded with those which are the result of a caustic poison. Those of the second kind may be divided into acute and chronic; the first sometimes occurring in a very short space of time. The following are the characters given by M. Chaussier: ‘The ulcerations vary in size, shape, and place; they occur particularly at the basis of the stomach, and the parts corresponding to the spleen and the diaphragm. The contents of the organ are then sometimes effused into the abdomen, or the thorax if the diaphragm be perforated, but most commonly there is no effusion, from the adhesion of the parts to those in the vicinity. If the adhesions be broken, a viscous, unctuous liquor, not fetid, flows out; it has sometimes the odor of musk, is always brownish, and mixed with blackish flocculi, as though fine charcoal was added to a mucous serum. The edges are soft, fringed sometimes with a blackish line, more or less marked. Elsewhere the stomach retains its

treme activity of the gastric juice, as manifested in its actions on the stomach and œsophagus, and also on adjacent viscera in the abdomen and chest, and then remembering that the like peculiar effects are never found in the right half of the stomach, we have almost indisputable evidence that the solvent is not produced but by the left end of the organ.”

* Rupture of the stomach may, however, occur, independent of ulceration or any very marked disease. M. Lefevre mentions several instances in which aliments of any indigestible nature seem to have been the occasional causes of the symptoms that precede the rupture. It is scarcely possible to conceive of more acute anguish than is experienced by those who die from this cause. (British and Foreign Med. Review, vol. vi. p. 221.)

ordinary shape and consistence; it presents no appearance of thickening or inflammation; the capillaries of its mucous membrane, appear, however, more developed, particularly in the vicinity of the perforation; this last sometimes forms in a few hours in people in health—most frequently after some days illness, and when no cause of external violence or poison can be suspected.' When the perforation is the result of a caustic, irritating poison, its edges are of the same thickness as the organ; sometimes they are hard and callous; in the spontaneous perforation the edges are thin, and formed only by the peritoneal membrane, the two other coats of the stomach being more extensively destroyed than the serous one. In this case, too, the opening is not so irregular as in that which results from the action of a corrosive substance. The circumference of perforations caused by nitric acid is yellow, from the chemical action of this substance. In the case of strong sulphuric acid, it is black. *Almost always when the perforation is the effect of poison, the parts not perforated are more or less inflamed, while traces of the same affection are found in the mouth, the pharynx, and the intestinal canal; on the other hand, for the most part in the case of spontaneous perforation, the unperforated parts present no appearance of inflammation.* This last character is not, however, constant; for, as on the one hand, perforations from poison are sometimes, though rarely, unattended by inflammation of the unperforated parts of the intestinal canal, so, on the other, spontaneous perforations may be observed, in which there is inflammation of the stomach and intestines."*

Dr. Christison makes the following observations: "Passing now to the differences between these gelatinized perforations and the perforations caused by the corrosive poisons, it may, in the first instance, be observed that the margin of a corroded aperture is commonly of a peculiar color; for example, yellow with

* Quarterly Journal of Foreign Medicine and Surgery, vol. viii. p. 258. The opinion of Christison, (second edition,) that perforation may be caused by worms, is doubted by the Dublin Journal of Medical and Chemical Science, vol. i. p. 64. [It is now generally admitted that intestinal worms do perforate the intestines. See Medical Gazette, pp. 650, 748. Taylor on Poisons, 165.]

nitric acid, brown with sulphuric acid and the alkalies, orange with iodine. But a much better, probably an infallible criterion, and one of universal application, is the following: Either the person dies very soon after the poison is introduced, in which case vital action may not be excited in the stomach, or he lives long enough for the ordinary consequences of violent irritation to ensue. In the former case, as a large quantity of poison must have been taken, and much vomiting cannot have occurred, part of the poison will be found in the stomach; in the latter case, the poison may have been all ejected, but in consequence of the longer duration of life, deep vascularity or black extravasation must be produced round the hole, and sometimes, too, in other parts of the stomach, and these will at once distinguish the appearance from a spontaneous aperture. There is no doubt that the stomach may be perforated by the strong corrosives, and yet hardly any of the poison be found in the stomach after death. Thus, in a case by Mertzdorff, of poisoning by sulphuric acid, where life was prolonged for twelve hours, he could detect by minute analysis only $4\frac{1}{2}$ grains of the acid in the contents and tissue of the stomach. But then the hole was surrounded by signs of vital reaction, and so was the spleen, upon which the aperture opened. Judging from what I have often seen in animals killed with oxalic acid, which is the most rapidly fatal of all the corrosives, so that little time is allowed for vital action, I should think that no poison can dissolve the stomach without unequivocal signs of violent irritation of the undissolved parts of the villous coat, which must secure an attentive observer from the mistake of confounding with such appearances the effects of spontaneous erosion. Spontaneous erosion is very generally united with unusual whiteness of the stomach, and there is never any material vascularity.*

Mr. Alfred S. Taylor has subsequently reviewed this subject in an elaborate essay "on perforations of the stomach from poisoning and disease." I subjoin a brief outline of his remarks, recommending, at the same time, a perusal of his observations and cases.

* Christison, p. 128.

There are four cases in legal medicine, he remarks, wherein a knowledge of this subject may be required. 1. A person may have died from perforations of the stomach through disease, and not from poison. 2. A person laboring under the disease may be the subject of poison. 3. A person laboring under the disease may have received blows or injuries on the abdomen, and then it will be necessary to state whether the perforation did or did not result from the violence used. 4. Perforations of the stomach from post-mortem changes may be mistaken for perforation from poison.

Perforation from poison may originate from corrosion, or by leading to ulceration. Of the corrosive poisons, such as the mineral acids, alkalies, corrosive sublimate, etc., their action is chemical and takes place immediately on contact. Their effects are well marked, particularly those of the acids, as we shall hereafter show. Corrosive sublimate has very rarely induced perforation, but should it, great vascularity of the stomach and œsophagus would undoubtedly accompany it. As to the perforation from ulceration produced by irritant poisons, as arsenic for example, this also is a very rare occurrence, and if it does happen, would undoubtedly also affect the fauces and œsophagus. When it is recollected that in most cases we can also have the aid of the history of previous symptoms and the results of chemical analysis, Mr. Taylor asserts that perforation from poisoning is not likely to be mistaken for the effect of disease.

Perforation of the stomach from simple or scirrhus ulceration is often a most insidious disease. Without any remarkable previous symptoms, individuals will be suddenly seized with most excruciating pain and die, in a majority of cases, within twenty-four hours; vomiting is then a common attendant, but diarrhœa, so universal a symptom in poisoning, is wanting. Indeed, the bowels are usually obstinately costive. On dissection, the appearances are well marked. An oval or rounded aperture, with smooth, soft, and fleshy-looking edges, is seen, and this is almost constantly situated in or near the lesser curvature, between the cardia and pylorus. Peritonitis is found to be the sole cause of death, whereas, in arsenical poisoning,

the appearances extend to the intestines, in correspondence with the symptoms. It is even questionable whether perforation from the effects of arsenic could be induced within the usual limit of these fatal cases.

On perforation by solution, (or digestion of the coats of the stomach after death,) it is not necessary to repeat Taylor's remark, further than to mention that he considers it a very rare occurrence, and that he conceives the fluid in question not to be the healthy gastric juice, but some altered state of that liquid.*

* Guy's Hospital Reports, vol. iv. pp. 8-62.

The medical literature of this subject is so extensive, that I must content myself with a selection from the numerous authorities. Among others, the following are worthy of careful study:—

Laisne. *Considerations Médico-légales sur les Erosions et Perforations spontanées de l'Estomac.*

Edinburgh Medico-Chirurgical Transactions, vol. i. p. 311; vol. ii. p. 331. Dr. Gairdner on Erosions of the Alimentary Canal.

Allan Burns on Digestion of the Stomach after Death. (Edinburgh Med. and Surgical Journal, vol. vi. p. 132.)

Cyclopaedia of Practical Medicine, articles *Perforation of Viscera* and *Softening of Organs*, by Dr. Carswell; also, the fifth fasciculus of the same author's Illustrations of the Elementary forms of Disease, London, 1834; and his papers in volume xxxiv. of the Edinburgh Medical and Surgical Journal.

Cyclopaedia of Practical Medicine, art. *Organic Diseases of the Stomach*, by Dr. Houghton.

Cruveilhier's Anatomie Pathologique, Nos. 4 and 10, *Ramollissement gélatiniforme*, and his remarks on simple ulcer of the stomach, in British and Foreign Med. Review, vol. vii. p. 241.

Langston Parker on the Stomach in its morbid states. (Reprinted in Dun-glison's American Med. Library.)

Orfila's Exhumations Juridiques, vol. ii. p. 216.

Dr. Abercrombie on Ulceration of the Stomach, in Edinburgh Medical and Surgical Journal, vol. xxi.; and his work on diseases of the Stomach.

Analysis of Andral's Clinique Médicale, in Edinburgh Med. and Surgical Journal, vol. xxiii. p. 161; and also his Pathological Anatomy.

Copland's Dictionary, art. *Lesions of the Digestive Canal.*

Dictionnaire des Sciences Médicales, art. *Perforation*, by Percy and Laurent.

Cooke's Morgagni, vol. ii. p. 26.

Imlach on Softening, Erosion, and Perforation of the Stomach. (Edinburgh Med. and Surg. Journal, vol. xlvii. p. 391.)

Medico-Chirurgical Review, vol. vi. p. 173, Louis on Softening. Ibid., vol. xxxi. p. 213; vol. xxxiii. p. 641, Parker on Ulceration of the Stomach. Vol. xxxviii. p. 217, Winter on Gastromalacia. Ibid., p. 235, Rokitsanski,

Although the intestines and gullet have been found perforated from natural causes, it is not probable that this can happen from corrosive poisons. Indeed, Dr. Christison states that he has not met with a single case of either in the course of his reading. As it respects the intestines, the poison will be either expelled in sufficient quantity from the stomach by vomiting, to prevent it, or the pylorus contracts and prevents the passage of every poison that is sufficiently concentrated to corrode. In the gullet the poison cannot remain a sufficient

of Vienna. *British and Foreign Med. Review*, vol. ii. p. 551, Droste on Softening. Vol. xiii. p. 516, Dahlerup's Dissertation. *New Orleans Med. and Surg. Journal*, vol. ii. p. 154, Carpenter on Perforation of the Stomach. *Archives Générales*, August and September, 1842, Dr. Lefevre's Memoir.

Dr. Ebermayer on Perforation. (*American Journal of Medical Sciences*, vol. iii. p. 452; vol. iv. p. 215.)

Broussais' Physiology.

Of cases, I will only refer to the following:—

Dr. Haviland, *Annals of Physiology*, N. S., vol. iv. p. 292. Mr. Want, *Eclectic Repertory*, vol. v. p. 495. Dr. Pascalis, *New York Medical Repository*, vol. xviii. p. 287. Dr. Cheeseman, *American Medical Recorder*, vol. iv. p. 151. Dr. Segalas, *Quarterly Journal of Foreign Medicine and Surgery*, vol. ii. p. 328. Dr. Peter, *ibid.*, vol. v. p. 297. Dr. J. B. Beck, *New York Medical and Physical Journal*, vol. ii. p. 455. Dr. A. L. Pierson, *New England Journal*, vol. xv. p. 134. Dr. Rawson, in *American Journal of Medical Sciences*, vol. vi. p. 391. See, also, *Edinburgh Med. and Surgical Journal*, vol. xix. pp. 483, 652; vol. xxvi. pp. 290, 451; vol. xxxvi. p. 445; vol. xlv. p. 257. *Medico-Chirurgical Review*, vol. viii. p. 516; vol. x. pp. 240, 494; vol. xiii. p. 464; vol. xiv. p. 334; vol. xv. p. 530; vol. xxiii. p. 333. *American Journal of Med. Sciences*, vol. vii. p. 522. Dr. McCormac, in *Lancet*, N. S., vol. ix. p. 475. Dr. Elliotson, *London Medical Gazette*, vol. ix. 379; vol. xii. p. 513. Dr. Drake, in *Western Journal of Medical and Physical Sciences*, vol. vii. p. 508. Mr. Crisp, in *Lancet*, N. S., vol. xxxii. p. 639. The author gives an analysis of the symptoms in some fifty recorded cases.

One of the earliest cases related of sudden death from ulceration of the stomach, is given by Dr. James Carmichael Smyth, in *Medical Communications*, vol. ii. p. 467.

Of rupture of the stomach consequent on ulceration, etc., cases are given by Dr. Crampton, and Mr. Travers, *Medico-Chirurgical Transactions*, vol. viii. p. 228; by Dr. Elliotson, *ibid.*, vol. xiii. p. 26; by Mr. Weeks, vol. xiv. p. 447; by Dr. Crampton, *Transactions of the King's and Queen's College of Physicians in Ireland*, vol. i. p. 1. Dr. Steinbeck, *British and Foreign Medical Review*, vol. ix. p. 238. Mr. Travers, *Medico-Chirurgical Transactions*, vol. xxiii. p. 8.

time to complete this alteration. It must either pass to the stomach or be rejected.*

I shall conclude this chapter with a few general remarks on the chemical examination, and the mode of treatment, in cases of poisoning.

Chemical examination. I have already given directions as to the preservation of the stomach and intestines, and their contents, and the mode of pursuing experiments, for the purpose of detecting noxious substances. Under each individual poison, the most certain tests, so far as they are known, will be mentioned. And I will add, that it is in these directions that modern medical jurisprudence so much exceeds ancient forms. Nothing can be stronger proof, nothing will convict the criminal in a more satisfactory manner, than the discovery of the poison in the body of the deceased, and the subsequent detection of it by chemical tests.†

* I find the following recent notice of the present subject by an able anatomist:—

“It is affirmed that one and an essential object of the vital principle, so called, is to give to the animal body a certain resistance against the operation of destructive chemical action. But much of this does not appear to be well founded. In the case of the stomach, for example, it is known that during life it resists the solvent powers of the gastric juice; but, as we learned first from Hunter, after death, if it happens that the organ contains food, the left end is frequently found dissolved. The most obvious explanation of this phenomena would be, that some vital power defends the stomach, during life, against the chemical solvent. But when carefully investigated, it is found that the solution takes place so rapidly as to affect the stomach while it is still so far alive that its muscular coat would respond to the galvanic stimulus; and, moreover, that even living animals, earthworms, and leeches, introduced into the stomach, inclosed within perforated spheres, so that they were guarded from muscular compression, are dissolved by the gastric juice. These considerations point, then, to another explanation, and in place of elucidating that one among the many marvels of animal existence, the defence of an organized tissue against an agent expressly provided in the economy to act upon such substances, by any particular vital property, we should rather seek for the reason in chemical action resisting chemical action; or, in other words, it may be assumed that whatever degree of protection is required is furnished by the defensive mucus of the organ. This protection is only necessary where there is food in the stomach, for at other times the elements of the gastric juice are inclosed within the different orders of epithelium cells.” (Mr. Grainger’s Hunterian Oration, London Medical Gazette, June 30, 1848.)

† [The great value of chemical evidence in cases of poisoning otherwise

In a number of cases, the search may be unsuccessful, but we must not, therefore, conclude that poison has not been the cause of death. It may have been all discharged by vomiting and purging. Murder is frequently attempted by administering large doses of poison, and in some individuals, these produce copious vomitings, which, indeed, is often assisted by the deceased drinking freely. Hence the chance of finding the poison is diminished, as it may have been rejected. Again, it may all have been absorbed. This has repeatedly occurred in cases where opium or laudanum has been known with certainty to have been taken, and yet no traces of it could be found. Some poisons also are decomposed. We shall see this in the case with corrosive sublimate, lunar caustic, etc.*

In all these cases, however, there is an additional investigation to be pursued, which may prove satisfactory. Although the poison is not present in a fluid or solid state in the contents of the stomach, yet it may exist in the tissues themselves, and hence, in repeated instances of late years, it has been detected by boiling down the stomach and intestines and experimenting on the fluids thus obtained.

doubtful, and the success of analyses of the body or its contents long after interment, have, perhaps, led to an over-estimate of the importance of this branch of evidence. It has been claimed that if poison cannot by proper chemical skill be obtained from a dead body it is a legitimate inference that no poison was taken, and the death must be ascribed to other causes. (Trial of William Palmer, for the murder of J. P. Cook, May, 1856.) It is, however, manifest that the discovery of poison in the body is by no means conclusive proof that the poison produced death; nor, on the other hand, is its non-discovery evidence that death was not caused by it. There are many poisons, especially those of organic origin, which cannot be detected by analysis, and as several poisons are extensively employed as medicines, their presence in the body will not, independently of symptoms and post-mortem appearances, justify an allegation of poisoning. See Poisoning by Strychnia, p. 269; Taylor, pp. 170, 198; Prof. Casper, *Handbuch der Ger. Med.*, 1857, p. 395. On the danger of imperfect analyses, see *Annales d'Hygiène*, vol. xxvi. p. 399; xxix. pp. 103, 474; *Pharmaceutical Journal*, January, 1858, p. 350; *Guy's Hospital Reports*, October, 1857, p. 497.—S. St. J.]

* See Christison on Poisons, p. 697; Taylor, p. 178. Drs. Christison and Coindet could not discover a trace of oxalic acid in the veins of a dog that had died thirty seconds after the injection of eight and a half grains of the acid into the femoral vein. (Christison, p. 18.)

How far putrefaction or decay of the body renders the detection of poison impossible, has been satisfactorily answered by the experiments of Orfila and Lesueur. They placed the following poisons—sulphuric and nitric acids, arsenic, corrosive sublimate, tartar emetic, sugar of lead, protomuriate of tin, blue vitriol, verdigris, lunar caustic, muriate of gold, acetate of morphia, muriate of brucia, acetate of strychnia, hydrocyanic acid, opium, and cantharides—in the dead body, and allowed them to remain for some time.

They found that the acids became neutralized by the ammonia disengaged during the decay of animal matter; that by the action of the animal matter, the salts of mercury, antimony, copper, tin, gold, silver, and likewise the salts of the vegetable alkaloids, undergo chemical decomposition, in consequence of which the bases become less soluble in water, or altogether insoluble; that acids may be detected after several years' interment, not always, however, in the free state; that the bases of the decomposed metallic salts may also be found after interment for several years; that arsenic, opium, and cantharides, undergo little change after a long interval of time, and are scarcely more difficult to discover in decayed than in recent animal mixtures; but that hydrocyanic acid disappears very soon, so as to be undistinguishable in the course of a few days.* [Soluble poisons, as oxalic acid, contained in the viscera, disappear during putrefaction. Strychnia is not essentially changed.†]

General outline of treatment in cases of poisoning. On this subject I must necessarily be brief; yet a few directions for the care of persons laboring under this grievous infliction can scarcely be here misplaced.

The great object, in all cases where it is practicable, is to administer antidotes; and of these, the chemical are the most striking and satisfactory in their operation. We are indebted

* Christison, p. 58; Orfila's *Exhumations Juridiques*, vol. ii. p. 265. A detailed account of these experiments is given in the *Edinburgh Medical and Surgical Journal*, vol. xxxi. p. 224; and *American Journal of Medical Sciences*, vol. iii. p. 226.

† *Guy's Hospital Reports*, October, 1856, p. 393. For the general processes of chemical analyses of poisons, see the *Treatises of Christison and Taylor*; *Bowman's Medical Chemistry*, part v.

to modern observers, and to Orfila in particular, for most of these. Thus the virtues of albumen as an antidote for corrosive sublimate and verdigris—of bark for tartar emetic—of the alkaline sulphates for sugar of lead—of the alkaline and earthy chlorides for liver of sulphur—have been pointed out. All of these either decompose the poison or change it to a less dangerous substance.

For some of the poisons, however, such antidotes are not to be found; and the grand indication, as indeed in all cases, is to remove the poisons as soon as possible, by exciting the action of the stomach to discharge them, or by the application of mechanical means. For the former, emetics are the most efficient; and among the latter, may be named the stomach-pump. In other places, I will speak of its history, and mention instances in which it has been found useful. At present I will only add, that unfortunately it is not always applicable. The poison sometimes acts too rapidly, and on other occasions is too destructive to parts to permit its use. Still it is often valuable; but it requires caution and experience, so that additional injury be not inflicted through its employment.

Dr. Watson, in a clinical lecture on the use and abuse of the stomach-pump, advises it, if the patient be insensible or refuse to swallow—while he discourages its application, if the individual can swallow or is able to vomit. There is sometimes danger from the delay, during its use, of the exhibition of antidotes. Nor must we conceal that serious injury has sometimes been inflicted by its employment in the hands of the unskillful. Chalk and mustard have been found in the lungs of persons operated on, and Dr. Roupell shows, in one of his plates, extensive injury to the mucous membrane of the stomach through its use.*

In cases of external poisoning, Sir David Barry has of late years revived the application of cupping-glasses to the part where the poison has been introduced, and in several cases it has proved useful. It prevents the absorption of the poison,

* Dr. Watson, in *London Med. Gazette*, vol. xvii. p. 412; *Ibid.*, p. 463; *London Med. and Surg. Journal*, vol. x. p. 736.

and may, by extracting blood from the wound, also withdraw the poison.*

Another mode, proposed for the same object, is the application of a ligature between the injured part and the trunk, so as to check the circulation. Bouillaud has shown the efficacy of this in several experiments, while Verniere has combined venesection with it. The veins between the wound and ligature are opened, and the blood which has passed through or near the poisoned part is thus discharged.†

* On this subject, and Sir David Barry's Experiments in particular, see London Medical Repository, vol. xxv. p. 176; Edinburgh Med. and Surg. Journal, vol. xxv. p. 462, vol. xxvii. p. 200.

Medico-Chirurgical Review, vol. ix. p. 313. Dr. Pennock's Experiments on the modus operandi of cupping-glasses, in arresting and preventing the effects of poisoned wounds, in American Journal of Med. Sciences, vol. ii. p. 9. Dr. Pennock inclines in favor of *increased pressure* as the cause of their efficacy.

Dr. Rodrigues' Experiments on ditto., American Journal of Med. Sciences, vol. ii. p. 307.

† Bouillaud, Edinburgh Medical and Surgical Journal, vol. xxviii. p. 227; Medico-Chirurgical Review, vol. x. p. 232; Bulletin des Sciences Médicales, vol. xi. p. 118; Verniere, Journal des Progrès, vol. iii. p. 121; Edinburgh Med. and Surg. Journal, vol. xxix. p. 450; Medico-Chirurgical Review, vol. xiv. p. 248.

NOTE.

A curious paper, on the Statistics of Poisoning in France, has been published in the Journal de Chimie Médicale, by Chevallier and Boys de Loury. The following is a brief abstract of it:—

In seven years, (from 1824 to 1832,) 273 individuals have been accused of poisoning; of these, 171 were acquitted, and 102 condemned. The substances employed were, in 93 cases, as follows:—

54 cases arsenic,	1 case tartar emetic,
7 " verdigris,	1 " opium,
5 " cantharides,	1 " acetate of lead,
5 " corrosive sublimate,	1 " white-lead,
4 " nux vomica,	1 " sulphuric acid,
3 " fly-powder,	1 " sulphate of zinc,
2 " nitric acid,	1 " mercurial ointment,
1 case sulphuret of arsenic,	5 cases unknown.

Of 81 cases, the poison was given in 34 instances in soup; 8 in milk; 7 in flour; 7 in wine; 8 in bread; 5 in pastry; 4 in chocolate; 4 in medicine;

2 in coffee; 2 in an unmixed state. (London Med. Gazette, vol. xvi. p. 114; Lancet, N. S., vol. xvi. p. 33.)

According to the return of the coroners of England and Wales, of all inquisitions held by them during 1837 and 1838, in which death, by verdict of jury, was found to have been caused by poison, there were of—

Arsenic	184	Prussic acid.....	27
Opium and its preparations..	186	Corrosive sublimate.....	12
Oxalic acid.....	19	All others.....	80
Nux vomica.....	3		—
Sulphuric acid.....	32	Total.....	543
Of this number, there were females.....			261
..	"	males	282
			543

(London Med. Gazette, vol. xxv. p. 284.)

My brother, Dr. John B. Beck, has given, in the Transactions of the New York State Medical Society, vol. vi. p. 66, the fatal cases from poisoning that occurred in the City of New York, during 1841, 1842, 1843, taken from the records of the coroner:—

There were 46 males and 37 females—total, 83; suicide, 50; by mistake or through ignorance, 28; unknown, 5.

Poisoned by arsenic.....	13
“ opium and its various preparations.....	51
“ corrosive sublimate.....	3
“ tartar emetic.....	1
“ sulphuric acid.....	2
“ tincture of sanguinaria.....	4
“ ardent spirits, or gin.....	2
“ alcohol and laudanum.....	2
“ strychnine.....	1
“ prussic acid.....	1
“ phosphorus.....	1
“ carbonate of potash.....	1
“ colchicum.....	1
	<hr/>
	83

See also Annales d'Hygiène, vol. xxiv. p. 282.

From the returns of the Registrar-General of England, it appears that the annual number of deaths by poisoning averages 536 for six years, 1848–1853; and that the increase for ten years, 1838–1848, is more than 100 per cent. In the kingdom of Denmark, three-fourths of all the poisonings are effected by the mineral acids. (Taylor, p. 222.)

CHAPTER XVII.

IRRITANT POISONS.

Division of irritant poisons into six orders. 1. THE ACIDS and their bases.

Sulphuric acid—its effects on man—appearances on dissection—chemical proofs—whether the last should be deemed indispensable for conviction—medico-legal cases—treatment. Nitric acid—effects—Tartra's arrangement of them—appearances on dissection—tests—antidotes. Muriatic acid—cases of poisoning. Acetic acid—cases of poisoning with it. Oxalic acid—symptoms—appearances on dissection—tests—antidotes—binoxalate of potash—rhubarb-plant. Phosphorus—effects—appearances on dissection—phosphorous acid—lucifer matches. Iodine—effects—tests—treatment; hydriodate of potash—effects—tests. Bromine—hydrobromate of potash—tests. 2. THE ALKALIES and their salts. Potash; subcarbonate of potash—effects—appearances on dissection—antidote; nitrate of potash—effects—treatment; supertartrate of potash; sulphate of potash? Soda ammonia, liquid and gaseous—hydrochlorate of ammonia. Quick-lime—oxymuriate of lime. Chlorides of soda and potash. Hydrogenated sulphuret of potash (liver of sulphur)—poisonous effects—antidote. Sulphuret of soda.

IRRITANT poisons are divided by Dr. Christison into five orders or groups, as follows: The acids, and their bases; the alkalies, and their salts; the metallic compounds; the vegetable and animal irritants; and the mechanical irritants. To these I will add the acrid gases.

In pursuing this arrangement, we shall consider, under the FIRST ORDER, the follow substances:—

Sulphuric acid, nitric acid, muriatic acid, acetic acid, oxalic acid, binoxalate of potash, phosphorus, iodine, hydriodate of potash, bromine, hydrobromate of potash.

And under the SECOND ORDER,—

Potash, subcarbonate of potash, nitrate of potash, soda, ammonia, muriate of ammonia, quick-lime, oxymuriate of lime, chloride of soda, liver of sulphur, sulphuret of soda.

I. *The Acids.*

SULPHURIC ACID, (oil of vitriol.) That this substance should sometimes be the cause of death may readily be conjectured; but it requires some acquaintance with human folly and wickedness to believe that it could be thought of as the instrument of suicide, and even of murder. Such is, however, too certainly the fact.*

* In 1808, a female was tried and convicted at Edinburgh, for the murder of her natural child, aged eighteen months, by pouring sulphuric acid down its throat. (Edinburgh Annual Register, vol i. part 2, p. 4.)

In 1819, another at Exeter, England, also for thus poisoning her child. (Gordon Smith, on Medical Evidence, p, 218.)

In 1817, a female was tried in this State, for poisoning an illegitimate child.

In 1824, Richard Overfield was condemned and executed at Shrewsbury, England, for the murder of his infant child three months old. (Edinburgh Med. and Surgical Journal, vol. xxii. p. 122.)

In 1828, a man was convicted at Strasburg, for attempting to poison his wife. (Ibid., vol. xxxiv. p. 213.)

In 1830, a Mrs. Humphrey, at Aberdeen, was convicted and executed, for murdering her husband. A full account of the trial is given by Dr. Christison, in *ibid.*, vol. xxxv. p. 298.

In 1831, a stepfather, at Manchester, for the murder of his child. Case related by Dr. Sinclair, *ibid.*, vol. xxxvi. p. 99.

Its fatal willful administration is thus not only a capital offence by the laws of all civilized countries, but its external application, so as to do some serious injury, is, by a special statute in Scotland, made punishable by death. This enactment originated in the quarrels between master and workmen in Glasgow, regarding the rate of wages; and the crime became so frequent as to render a law necessary. The clause is as follows: "If any person shall willfully, maliciously, and unlawfully throw at, or otherwise apply to any of his majesty's subjects, any sulphuric acid or other corrosive substance, calculated by external application to burn or injure the human frame, with intent in so doing, or by means thereof, to murder, maim, or disfigure or disable such subject, or with intent to do some other grievous bodily harm," and if such intent is accomplished, the person convicted shall suffer death. Of course, throwing the acid so as to injure or destroy the dress merely, would not be capital. Under this act, a female (Macmillan) was convicted in 1828. I shall notice this case hereafter.

In England also, by a recent enactment, (July 17, 1837,) "sending explosive substances, or throwing destructive matter, with intent to burn, maim, disfigure, or disable any person, or to do some other grievous injury, and whereby in any of the cases aforesaid any person shall be burnt, maimed, disfigured, or disabled, or receive some other grievous bodily harm," is declared felony. The deficiency in the former law is thus supplied. In 1835,

The following are some cases illustrative of its effects:—

Joseph Parangue, a soldier, about the end of January, 1798, between seven and eight in the morning, swallowed, by mistake, a glass of sulphuric acid, imagining it to be brandy. He drank it off at once, with his head back, and poured it from a distance into his mouth. By this means he did not discover his mistake until he drew his breath. He was instantly conveyed to the hospital, and Dr. Desgranges being at hand, immediately saw him. Excessive vomiting, convulsive agitation of the muscles of the face, violent cramp in the stomach, and an acrid burning heat in the throat and oesophagus were present. The body was icy cold; the pulse was small, concentrated, and irregular, and the breathing difficult. The carbonate of magnesia, suspended in water, was administered with considerable relief; and although vomiting returned once, yet by the continuance of this remedy, the anxiety and pain diminished, the pulse rose, and a genial heat was diffused over the body. The antiphlogistic regimen and diluents were subsequently required to remove the consequences of this potation. The whole of the mouth and throat was found, on the subsequent day, excoriated and covered with eschars; the epiglottis swelled; and on the fourth day, a slough from the uvula almost threatened suffocation. This gradually came away, and he finally recovered, but a painful sensibility of the throat and stomach remained for a length of time, especially when he ate hastily or used food that was indigestible.*

A female swallowed some for the purpose of destroying her-

a female, through malice, threw in her master's face a quantity of strong sulphuric acid, which produced serious disfigurement. She was tried on the capital charge for attempting to maim, disfigure, etc., but as the statute (9 George IV. chap. xxxi.) already quoted restricted this disfiguring to stabbing, maiming, or *wounding*, it became a question, whether sulphuric acid was capable of producing a wound, within the meaning of the statute. The judges decided in the negative. She was therefore acquitted of the felony and only punished for a misdemeanor. (British and Foreign Med. Review, vol. iii. p. 535; *Rex v. Morrow*, Moody's Crown Cases reserved, vol. i. p. 456.)

In France, as I have already stated, (vol. ii. p. 283,) the throwing of a corrosive substance, so as to maim or disfigure, without affecting life, would be deemed a wound, and punished accordingly.

* Orfila's Toxicology, vol. i. p. 315; Foderé, vol. iv. p. 96.

self, and in four hours thereafter was brought to the Hôtel-Dieu. Pain, coldness of the skin, constipation, and inquietude were present, with copious and repeated vomitings of a deep blue-colored and glairy fluid. Proper remedies were given, but the symptoms increased in severity. On the second day, the face appeared greatly deranged, the cold on the surface increased, the pulse became insensible in the wrists and carotids: the breath was extremely fetid; a few drops of very high-colored urine escaped from time to time, and the disquietude and agitation were extreme. She could not bear any kind of covering, and the region of the stomach was exquisitely sensible to the slightest touch. On the fourth day, she was incapable of resting a single instant in the same position, and rose up for the purpose of going to a cold place. Death finally relieved her on the fifth day. She preserved her reason to the last.*

In one instance, quoted from Tulpus, a miliary eruption appeared over the whole body, in addition to the ordinary symptoms.

Its effects on an infant are illustrated by an instance that occurred to Dr. Bateman:† A mother, by mistake, administered about a teaspoonful to her child, aged two and a half years. This was at half past four P.M. She immediately excited vomiting by putting her finger in the child's throat, and the matter brought up resembled coffee-grounds. It seemed to suffer little pain, except when vomiting, which occasioned crying, and it died easily, and almost unperceived, at nine the same evening.‡

* Orfila's Toxicology, vol. i. p. 322, quoted from Tartra.

† It is very important to remember that if the poison be given with a spoon or be swallowed from a phial, the *mouth* may escape the action of the acid. (TAYLOR.)

‡ Edinburgh Medical and Surgical Journal, vol. x. p. 257. In addition to the above, I will refer to such cases as I have noted.

London Medical Repository, vol. xiv. p. 160. Two cases, from a German journal, one of suicide, and the other accidental. The former died in a few hours; the latter survived two months.

Chapman's Journal, vol. viii. p. 218. A chronic case, which ended in a stricture of the œsophagus. After two years' suffering, the patient died of hunger. This is quoted from the Bulletin de la Société Médicale d'Emulation.

London Medical Repository, vol. xxvii. p. 550. Death in fifteen days. Case by Dr. Lebidois. *Archives Générales*.

These cases (particularly the first and second) give a full view of the symptoms ordinarily observed, and it is therefore

Littel's Journal of Foreign Medicine, vol. i. p. 313, by Dr. Robert. Death in sixty-eight days. This is also a French case.

London Medical Gazette, vol. xi. p. 813, by Dupuytren. Died in seven hours.

Ibid., vol. xiv. p. 30, by Louis, at Hospital de la Pitié; survived two months.

Ibid., vol. xvii. p. 339, fatal in seventeen days, from inflammation of the gullet and stomach; case by Dr. Clendenning. Ibid., vol. xxii. p. 76; by Dr. John Wilson. The patient survived forty-five weeks, having, at the end of six months, thrown up, with violent coughing, a cylindrical tube eight or nine inches in length. On dissection, the upper third of the œsophagus shone like an old cicatrix; the lower two-thirds were thickened, narrowed, and very vascular. There was a perforation of the stomach, with softened edges. Vol. xxix. p. 147; by J. B. Thomson. Edinburgh Med. and Surgical Journal, vol. xxxvi. p. 99, cases by Dr. Sinclair, one fatal in fifty-five hours, and the other, a child nearly five years old, in four and a half hours. Ibid., vol. liii. p. 401, by Mr. Watson. Ibid., vol. liii. p. 406, by Dr. Craigie. The patient, an adult, died in less than four hours. Dr. Craigie enumerates a large number of cases recorded in various periodicals, etc.

Midland Medical and Surgical Reporter, vol. i. p. 340, by Mr. Hebb; died in a few hours.

Dr. Roupell, Illustration 5; death in twelve hours.

British and Foreign Med. Review, vol. iii. p. 539. Case by Dr. Braun, (from Henke's Zeitschrift); death in twelve weeks.

British Annals of Medicine, vol. i. p. 714. Case at the London Hospital, by Mr. Bovrenson.

Guy's Hospital Reports, vol. iv. p. 297. Case by Alfred S. Taylor: death in twenty-five hours. London and Edinburgh Monthly Journal Med. Science. Case by Mr. Thomson; death ensued nine hours after taking a quantity accidentally. (Vol. ii. p. 879.)

London Medical Gazette, vol. xxx. p. 352. Case of Dr. Schoffern. Along with the usual morbid appearances, the kidneys were much inflamed, and indications of sulphuric acid were found in the urine.

Cases of recovery. Edinburgh Medical and Surgical Journal, vol. xxvi. p. 221 (from Horn's Journal). A female aged nineteen; a tetanic affection continued for some days, and the lining membrane of the mouth was separated and discharged. Ibid., vol. xlvi. p. 262; Mr. Syme mentions an instance where stricture of the œsophagus was induced after the early symptoms were removed. The patient lived chiefly on boiled milk and the watery part of broth. The stricture was gradually removed by the use of bougies.

New York Medical and Physical Journal, vol. vii. p. 563, by Dr. Stewart.

London Medical Gazette, vol. iii. p. 253, by Mr. Orr.

Ibid., vol. iii. p. 687. Vol. xxv. p. 944, by Mr. Blyth.

London Medical Quarterly Review, vol. iv. p. 119, quoted from Dr. Rust.

not necessary to repeat them. One remarkable characteristic, according to M. Pereira, is that the mental faculties are unaffected even up to a few minutes before death.*

An extraordinary case of voluntary injection of sulphuric acid into the vagina for the purpose of inducing abortion, is said to have lately happened in France. The result was extensive inflammation and a complete obliteration of the vagina. When delivery came on, the Cæsarean operation was required, but both mother and child perished.†

Appearances on dissection. In the case of a female, related by Tartra, the abdominal viscera were for the most part oedematous, and the coats of the duodenum in several points nearly dissolved. The stomach externally showed great distention, was of a dark color, and exhibited several spots indicative of deep disorganization. The mucous membrane of the œsophagus was burnt, blackish, and partly detached. The stomach contained a dark and very fetid fluid, similar to what she had vomited, and it was much thickened in some points and corroded in others. The internal coat was entirely dissolved, and reduced to a state of mucus throughout the greatest part of its extent. The pylorus presented the most decided marks of disorganization; the coats were black and puffed up, and almost closed the orifice. The duodenum and jejunum were partly destroyed and burnt, and attacked with sphacelus, and the whole of the intestinal canal partook more or less of the injury.

In Dr. Bateman's case, the omentum was seen converted into a black pulpy mass, but still possessing sufficient tenacity to retain the food which had escaped from the stomach. There

London Med. and Surgical Journal, vol. viii. p. 284. An adult male, who had swallowed four ounces.

Medico-Chirurgical Review, vol. xxxii. p. 284. A child five weeks old recovered by the stomach-pump, magnesia, soap, and water; case by Dr. O'Brien. Ibid., p. 399; case by Mr. Porter.

Lancet, vol. xxii. p. 782, by Mr. Gardner. London and Edinburgh Monthly Journal Med. Sciences, vol. ii. pp. 880, 951. Case by Mr. Thomson.

* London Medical Gazette, vol. xvii. p. 817.

† Lancet, N. S., vol. viii. p. 38.

A case of chronic poisoning by sulphuric acid. (Medical Times and Gaz., December 19, 1857, p. 629.)

was also in the omentum a small quantity of dark-colored fluid, similar to what had been vomited. In the stomach there was an erosion or aperture about three inches in diameter, bordered by thickened edges of a dark-brown cinder-like appearance. The œsophagus, with the exception of a slight purple blush, showed no marks of disease. There was an appearance of inflammation toward the cardia, but none toward the pylorus. The intestines were free from inflammation, although they were strongly marked with transverse corrugated rings.

In the other cases referred to, the appearances varied with the length of time that the patient survived after taking the poison. When some months had elapsed, the stomach was sometimes seen extremely contracted, and its membranes thickened. Indeed, all the results of severe and long-continued inflammation have occurred not only in this part, but in the œsophagus, throat, etc.

I must add, however, that corrosion of the stomach and solution and perforation of its tissues does not occur very frequently. This has been distinctly shown by Dr. Craigie, in his analysis of cases on record. The injury inflicted is, however, always more or less serious.

Any further peculiarities that have sometimes been noticed will be mentioned under the head of nitric acid, as the effects of both are in many respects similar.*

Professor Carus relates the following remarkable circumstance: A woman, at the completion of the full time of utero-

* Dr. James Johnson, at a meeting of the Westminster Medical Society, in October, 1836, referred to a curious case in the Transactions of the London Medical Society: Two ounces of strong sulphuric acid had been swallowed. After some severe symptoms the patient rallied and apparently recovered, but a few days afterwards, during a severe fit of coughing, he brought up a quantity of the acid in its pure state, which produced a fatal inflammation of the trachea, the acid having been a fortnight in the stomach. After death, it was ascertained that this acid had been surrounded by a cyst formed by secretions from the stomach, and which burst during coughing.

Mr. Ure said that some experiments which he had lately made seemed to corroborate this case. Sulphuric, nitric, and other acids being dropped into albumen, a cyst formed around the globules of acid and kept them pure for a long time. (*Lancet*, N. S., vol. xix. p. 196.)

gestation, poisoned herself with concentrated sulphuric acid. She concealed the deed till the instant of her death, when the last efforts of nature were employed in the expulsion of the child. On dissection, the acid was found in the cavity of the pleura of the foetus, in that of the peritoneum, in the heart, the bladder, and even in the water of the amnios.* [It has been a disputed question whether sulphuric acid is absorbed and eliminated.†]

Effects on animals. It would certainly seem unnecessary to ascertain the effects of the injection of sulphuric acid into the veins, since, so far as I can ascertain, no practical purpose is to be gained by it.‡ Orfila has, however, instituted some experiments in this way. It caused instant death, by coagulating the blood. When introduced into the stomach, it killed by the inflammation and disorganization of that organ, and when applied to the skin, by the burn that it produced, or the supuration of which it was the consequence.

The other acids (nitric, muriatic, phosphoric, fluoric, etc.,) acted in a similar manner. It will, therefore, not be necessary to notice this head again, unless there is something peculiar to be mentioned.

Chemical proofs. If there are any instances of poisoning in which the appearances found on dissection are to be deemed of greater weight than the chemical proofs, it is a case of poisoning by the mineral acids. Their effects are so striking and so little liable to be mistaken for natural appearances that a doubt can hardly arise.§ The necessity of relying on these is in-

* Bulletin des Sciences Médicales, vol. xiii. p. 72. Additional cases, illustrating the appearances found on dissection, are given in Edinburgh Med. and Surg. Journal, vol. lvi. p. 536, from Dr. Houston's catalogue of preparations in the museum of the Royal College of Surgeons of Ireland.

† See Taylor, p. 41; Med. Gazette, vol. xlviii. p. 330.

‡ And particularly as Fracassiti performed the same experiments, with similar results, one hundred and fifty years ago. (See Philosophical Transactions, vol. ii. p. 490.)

§ "Thus," says Dr. Christison, "what fallacy can intervene to render the following opinion doubtful? There were vesicles and brown streaks on the lips, neck, and shoulders, similar to the effects of burning; almost total separation of the lining membrane of the mouth, throat, epiglottis, and gullet; perforation of the stomach, with a margin half an inch wide, which was

creased by the difficulty of satisfactorily detecting the presence of the acid in all cases. I shall mention the tests recommended by Professor Christison and others, and then state some medico-legal cases that have occurred in England and France.

When concentrated, its peculiar appearance, its corrosive power, its action on litmus, the heat induced by the addition of water, and, above all, the production of fumes of sulphurous acid, by boiling it with wood, copper-filings, or mercury, serve to distinguish it.

When diluted, add pure nitric acid, and subsequently, a solution of the nitrate of barytes. A heavy white insoluble precipitate, consisting of sulphate of barytes, falls down. This may be collected, filtered, and dried, and then mixed with a little charcoal powder and exposed to heat in a platinum spoon. Sulphuret of barium is thus formed. If we add water to this, and afterwards a little muriatic acid, and then present over the mixture a bit of white paper, moistened with acetate or nitrate of lead, the sulphuretted hydrogen from the decomposed sulphuret, will blacken the paper.

When mixed with animal or vegetable matter. If it be required to analyze the stains on clothes, we should first ascertain whether any sourness be present. This is found to continue for a length of time after the acid has been applied. Then cut out the stained spots, boil them in distilled water, test the acidity of the fluid by litmus, and afterwards apply nitric acid and nitrate of barytes, as above directed. If there are indications of sulphuric acid, the next question is, whether this is free or combined with a base in the form of a neutral salt.

In analyzing the contents of the stomach, many sources of fallacy arise from the combination of the acid with its contents, or with portions of the animal membrane. It is known that free acids, as the muriatic and acetic, exist in the stomach, and the difficulty of discrimination is thus greatly increased. Instead, therefore, of quoting in detail the process of Dr. Christison for ascertaining whether the acid is combined with

extensively charred and surrounded by a red areola. From these appearances alone, Mertzdorff declared that the child must have been poisoned by sulphuric acid." (Christison, p. 164.)

a base, or, in other words, whether a sulphate has been the cause, I will content myself with referring to his work, and will only recommend that if the appearances on dissection, in combination with the tests of the presence of sulphuric acid, in some one or other form, in the stomach, do not suffice to indicate poisoning by it, not to rely on additional experiments. I am justified in this advice, I apprehend, from the observations of Christison, Devergie, and Orfila.*

What testimony has been considered sufficient for conviction, will be seen by a review of some trials.

In Overfield's case, the child, three months old, was in perfect health at 8 A.M.; between 11 and 12 o'clock the mother was heard to scream, and a witness, on entering the house, found the infant in great agony. It was immediately taken to

* Christison, p. 143; Devergie, in *Annales d'Hygiène*, vol. ii. p. 213; Orfila, in *ibid.*, vol. x. p. 126; *Lancet*, N. S., vol. vii. p. 132.

A practical illustration of the difficulties thus occurring is given by Dr. R. D. Thomson. (Report of the British Association, 1840; appendix, p. 84.) The case occurred before the Central Criminal Court in London:—

A woman, in a fit of rage, threw a quantity of oil of vitriol at the face of a cab-master, and before he could wash off the acid, two minutes had expired; the consequence was loss of vision in the eye. But besides having the eye injured, his hat was also discolored. This was sent to Dr. Thomson, to determine the nature of the agent used. The result was that this hat, as well as an uninjured one, contained sulphuric acid, as tested by nitrate of barytes, and a solution of the soluble matter of both states of this article of dress afforded an acid reaction. It was therefore necessary to adopt some method which would afford a discriminatory test between the free and combined acid; the usual mode, viz., by boiling with carbonate of lead, and concluding, if any insoluble sulphate of lead was formed, that the acid existed in a free state, was found to be totally fallacious, because carbonate of lead, contrary to the opinion stated in works of medical jurisprudence, decomposes sulphate of soda. Besides, it was shown that many of the so-called neutral sulphates exhibit, in reality, an acid reaction upon test-paper, as in the instances generally of sulphates of potash, iron, soda, barytes, and also, in the cases of alum, etc., and hence the excess of acid attached to these salts would be apt to act as free acid upon the barytes test. The author, therefore, concludes that the only demonstrative proof which chemistry affords is a quantitative analysis. Thus he found the entire hat to contain .356 per cent. of sulphuric acid, probably in the state of alum and copperas, and the injured hat 1.379 per cent.; or, in other words, the hat had received from the injury 1.023 per cent. of free sulphuric acid. Here then was afforded clear evidence of the nature of the agent employed, and which could not have been conclusive, if the matter examined had only amounted to a drop or stain.

the surgeon. The lips were white and shriveled, and had small blisters on them. The child's clothes, made of dyed cotton, had some red spots on them, and the surgeon, on applying his lips to these, found an extremely acid taste. It died at 3 P. M. The inside of the mouth and gullet were blistered, and their inner lining corroded. So also the great curvature of the stomach, which resembled wet brown paper. A pint of bloody fluid was obtained, and which was found to contain sulphuric acid. Overfield was a workman in a carpet manufactory, and had access to the factory stores of sulphuric acid. He was convicted and executed.*

Mrs. Macmillan, at Edinburgh, threw some sulphuric acid over Archibald Campbell, on the 17th of October, 1827. The skin on the left side of the face was partially removed. The left eyeball was injured, and both eyelids inflamed and swollen. The skin of the inside of the lips was white and swollen, as was also the back of the left hand. Campbell was brought to the infirmary in great pain, which was relieved by proper applications. Soon, however, the pain in the eye extended to the head; venesection, etc., proved of no avail, and the cornea burst. To this followed inflammation of the vein in which he had been bled, severe fever, and symptoms of pulmonary inflammation. He died on the 30th.

On dissection, there were found marks of inflammation in the veins, lungs, and pleura, with serous effusion.

Mrs. Macmillan was indicted under the recent Scotch statute. A hat, stock, and sleeve of a coat, injured by the acid, were examined by Drs. Christison and Turner. Portions of each, after being divided into small fragments, were boiled with distilled water. The filtered fluid had an acid taste, reddened litmus, and yielded, with acetate of barytes, a copious brownish precipitate, which was rendered white by nitric acid. This precipitate, when dried, was mixed with a little charcoal and heated. On adding muriatic acid, sulphuretted hydrogen was emitted, which blackened a paper dipped in acetate of lead.

Mrs. Macmillan was convicted; but as this was the first case

* Edinburgh Medical and Surgical Journal, vol. xxii. p. 322.

under the new act, she was only condemned to perpetual banishment.*

Mrs. Humphrey, a butcher's wife at Aberdeen, was tried there for murdering her husband, by pouring sulphuric acid down his throat while asleep. The circumstantial evidence was very strong that she alone could have given it to him. He was in a state of intoxication on going to bed; and after some hours, the servant, who had gone to see him at the request of her mistress, found him complaining of burning in his throat, and he said that he awoke suddenly with these symptoms. Frothing, and difficulty in swallowing and speaking, followed. On attempting to take some milk it returned curdled. When seen by a surgeon, all the marks of the action of a corrosive substance were present. He continued to labor under its effects, gradually sinking, and finally died in forty-seven hours from the commencement of his illness. On dissection, two brownish marks were seen at the corners of his mouth, and the gums and part of the inside of the lips were of an almost milky whiteness. The back part of the tongue had lost its investing membrane, and was of a red color, while its fore part was covered with a whitish-brown crust. The pharynx had a similar appearance. The membrane covering the epiglottis was ash colored, much thickened, and in some places detached. The stomach was overspread with numerous erosions and ulcerations. It contained about three ounces of a thick, reddish liquid: but no sulphuric acid could be detected in it, nor in that obtained from the intestines. But pieces of a blanket, a bed-cover, a sheet, and a shirt, used or worn by the deceased on the night of his illness, all presented various stains and corroded spots, and, on the application of test, exhibited marks of the presence of sulphuric acid. Other positions were sent to Dr. Christison, who examined them seven weeks after the man's illness commenced, and corroborated the opinion of the physicians of Aberdeen. The female was convicted, and, before execution, confessed her guilt.†

* Edinburgh Medical and Surgical Journal, vol. xxxi. p. 229; Syme's *Judiciary Reports*, p. 289.

† Edinburgh Medical and Surgical Journal, vol. xxxv. pp. 298 to 316.

In a French case of an infant poisoned by oil of vitriol, parts of the clothes and other articles on which the acid had fallen, were treated with water, and then tested with hydrochlorate (muriate) of barytes, and they gave abundant precipitates. A portion of the skin of the lower lip and of the tongue, when washed in water, made it distinctly acid. So also the matters vomited, when treated with distilled water and filtered, gave a precipitate with muriate of barytes; but neither the liquid contained in the stomach, nor portions of the stomach itself, gave any marked indications. The examiners, (Guersent, Chevallier, Barruel, and Denis,) notwithstanding, gave it as their opinion that the child had been poisoned by sulphuric acid.*

In a recent examination of the stomach of a suicide, with its contents, by Devergie and Taufflieb, they experienced the difficulties already indicated, of establishing the presence of free sulphuric acid by processes now in use; and as a substitute, employed the *iodic acid* in the following manner: The stomach having been boiled in distilled water, was now heated to redness in a glass vessel, in order to produce decomposition; and to the neck of this vessel was attached a receiver, containing a solution of ammonia. In order to ascertain whether this fluid held any sulphite of ammonia, a few drops of a solution of iodic acid, to which starch had already been added, (and a drop of hydrochloric acid to neutralize the ammonia,) were poured into it. The mixture turned immediately of a blue color. This result proved to us, says the reporters, that a certain portion of sulphuric acid was present in the receiver, and that the experiment had changed the sulphite into the sulphate of ammonia, the oxygen of the iodic acid being given off to

* Annales d'Hygiène, vol. iv. p. 205. A case in which a large quantity of sulphuric acid was added to coffee, for the purpose of poisoning a man and his wife, is stated by Barruel, in *ibid.*, vol. ix. p. 392. He applied the test already recommended.

In the case related by Mr. Taylor, the contents of the stomach, with the organ itself, were digested in water, and, after filtration, the liquor obtained was tested, but there was not the slightest indication of sulphuric acid, either free or combined. "The poison had, therefore," says Mr. Taylor, "been effectually removed by vomiting and purging: aided, perhaps, by the action of magnesia, which had been freely exhibited."

it, while the iodine, thus rendered free, gives its characteristic effect on starch. On pursuing the experiment with various portions of the suspected fluid, the compound procured was treated with barytes, and gave its white precipitate. The iodate of barytes was decomposed by heat, while the residue, after the usual manipulations, was found to be sulphate of barium.*

Treatment. Water, containing calcined magnesia in suspension, must be instantly administered; or if this cannot be procured, chalk and water, or soap and water. The caustic must thus be neutralized, or the patient is lost. In an emergency, Dr. Christison advises that the lime from a white-washed apartment be taken, and beat down into a thin paste with water, and thus given. Milk, or mild diluents, are also proper at this time. Dr. Craigie, indeed, advises that *milk*, instead of *water*, should be the menstruum for administering the magnesia, or the alkaline carbonates. The action of the acids may thus be more rapidly diverted from the stomach. [Taylor suggests that a solution of carbonate of soda in milk and water, given in small quantities at intervals, is more efficient in neutralizing the acid. Carbonate of magnesia with oil, has been very beneficial.]

The subsequent treatment must depend on the degree of inflammation present.†

* Annales d'Hygiène, vol. xiii. p. 427. If the observation of Vogel be confirmed, that arsenic (in the form of arsenious acid) is present in concentrated sulphuric acid, it may be well to test a portion in doubtful cases, with sulphuretted hydrogen. The precipitate, in such a case, would be sulphur and orpiment. Concentrated S. A., it is added, can dissolve one-third of its weight of arsenious acid, of which, however, the greater part separates on cooling. (London and Edin. Phil. Magazine, vol. vii. p. 235.)

† M. Bouchardat, of Geneva, (Annales d'Hygiène, vol. xvii. p. 362,) is of opinion that death may occur from taking sulphuric acid, through its direct action or by absorption. In the former, there will be high inflammation and severe suffering; but in the latter, these will be wanting to a very great extent, the pains will not be severe, and we have reason to augur a favorable termination, when a feeble pulse, cold extremities, and cramps suddenly supervene and destroy the patient. In two instances, he found the blood coagulated in the femoral artery, so as to obliterate its canal. The heart and aorta in one of these were also filled with coagula. If this theory be admitted, he suggests that instead of magnesia, we should administer the

The substance commonly called *indigo blue*, and now much in use, is usually prepared by adding sulphuric acid to indigo, and a portion of the acid is probably more or less in a free state. At one of the manufactories in France, a workman, accused of a robbery, swallowed from 700 to 800 grammes (a gramme being fifteen and a half grains) of the above liquid. Repeated vomitings ensued, and the matter thrown up produced a marked effervescence. His mouth and clothes were stained of a blue color. On removal to the hospital, magnesia diffused in milk was copiously given, and after a few days the patient was discharged cured.*

NITRIC ACID. We are indebted to Dr. Tartra, of Paris, for an able and comprehensive essay on this substance as a poison; and from the extracts given by Orfila, and a most instructive analysis contained in the *Edinburgh Medical and Surgical Journal*, I have taken the following particulars.†

Dr. Tartra arranges the cases of poisoning by nitric acid into four classes: 1. When the death is speedy, for it is never sudden, it commonly takes place from the primary effects in about twenty-four hours, varying from six to forty-eight hours. 1. When it proves fatal from its secondary effects, at various distances of time, from fifteen days to some years. 3. When death does not take place, but the recovery is imperfect. 4. When a perfect cure is sooner or later obtained.

1. The following example will give a tolerable idea of the progress of the symptoms in the first case: A man driven by

bicarbonates of soda or potash, which pass rapidly into the blood, and may check the formation of coagula.

Dr. Christison, however, after referring to some instances in which the blood was thus found coagulated, remarks that "this state of the blood is not the effect of the poison; but its healthy state, and a striking appearance in contradiction to what is observed after death from most other poisons."

* *Encyclographie des Sci. Méd.*, vol. vi. p. 12. The barytic test is employed in the usual way for detection of the acid in this form; the blue color may be discharged by boiling with nitric acid. An instance of poisoning by the aromatic sulphuric acid of the pharmacopœias is given in the *Medical Gazette*, vol. xxv. p. 944.

† Orfila's *Toxicology*, vol. i. pp. 329 to 360, vol. ii. p. 560; *Edinburgh Medical and Surgical Journal*, vol. ix. p. 369; Review of "*Traité de l'empoisonnement par l'acide nitrique*, par A. E. Tartra, médecin. Paris, 1802." I have subsequently obtained the work itself, but find nothing to add.

distress to commit suicide, under the greatest agitation of mind, and upon an empty stomach, swallowed at a draught two ounces of concentrated nitric acid. Instantly he was seized with the most excruciating pains and agitations, and could not lie in bed, but rolled himself upon the floor. Vomiting came on, accompanied by a general sensation of coldness, especially in the extremities. Every time he vomited the matter effervesced upon the pavement. He got a solution of soap and oil. In two hours he was brought to the hospital; and upon the road he frequently vomited and stopped to drink. On his arrival, he got emollient drinks, especially linseed tea, in great abundance. He was in continual agitation, and his countenance very much altered; he vomited every instant a blackish glairy matter; he opened his mouth easily, and his tongue was white, with a tinge of yellow; he had acute pains in his mouth, along the œsophagus, and in his stomach; his belly, slightly tense, could not bear the slightest pressure, it so excessively augmented his pains. The surface of his body was cold; his pulse small, concentrated, and frequent; he had hiccough, and his respiration was laborious. His symptoms increased; he uttered sighs and lamentations; his limbs became icy; a cold sweat covered his whole body; his pulse was almost imperceptible, and the pain was constant. Still he could rise and make continual and useless efforts to quench his thirst, and satisfy his urgent desire to make water and go to stool. He continued in this state during the night. The matter vomited became more clear, and of a yellow color. He at last made a few drops of urine. The shocking appearance of his body already resembled that of a corpse, but he retained his senses, and was speaking when he expired, nineteen hours after swallowing the acid.

The burning heat and pains which are commonly the immediate effects of nitric acid when swallowed present striking contrasts. In general, they are not in proportion to the quantity or strength of the acid swallowed. Often persons who have taken only a small dose are seized with the most excruciating pains; while some of those who have swallowed a great quantity, two or three ounces for example, have had scarcely any suffering, but remained very tranquil. In the

first case, the patients either recover or survive a long time; in the second, speedy death is almost always the consequence. Thus, a young man of twenty died in twenty hours, without any agitation or signs of acute pain. On opening the body, the highest degree of disorganization appeared: perforation of the stomach, and great effusion of its contents into the abdomen.

A woman said she had taken nitric acid, but she seemed so little affected by it that many thought she was imposing on them. There was no agitation, no pain or vomiting; but the smallness of the pulse, lassitude, and prostration of strength rather indicated a typhus fever. Next day she died; and on examining the body, there was found the greatest degree of disorganization that nitric acid is capable of producing: perforation of the stomach, gangrenous spots, effusion into the abdomen, marked erosion of all the viscera, and general yellow color.

But when the acid, from deficient quantity or strength, only acts on the mucous membranes, it does not always prove fatal; but the pains are excessive, and the colic dreadful. In the one case, the sensibility seems to be annihilated; in the other, excited in the highest degree. Here, as on many other occasions, the pain is to a certain degree proportionate to the severity of the affection; but after a certain point, it seems rather to be in an inverse ratio.

Out of fifty-six cases, death from the primary effects took place in nineteen.

2. The second variety of the progress and termination of poisoning by nitric acid exhibits at first the same phenomena as the preceding; but less alarming symptoms succeed by degrees, anxiety, irregular fever, dryness of the skin, spasmodic contraction of the extremities, wandering vague pains, deep and difficult inspirations, dryness of the tongue and throat, excessive thirst, deep pain in the region of the stomach, habitual tension of the abdomen, obstinate costiveness, vomiting less frequent, a kind of copious salivation, uneasiness in the throat from the imperfect detachment of the flakes of the membrane lining it, portions of it still partially adhering,

frequently floating in the pharynx, and disturbing both respiration and deglutition.

The pulse is often miserable, and the slow fever has no remission; the cold continues over the surface of the body, and there are irregular fits of shivering occasionally. Every kind of food, solid or liquid, is vomited. Milk alone seems to agree with the stomach. After some time, the inner membrane of the alimentary canal detaches itself in portions, which are discharged by vomiting, with floods of frothy and intolerably fetid saliva. Membranous flakes, swelled, rotten, and often of a very great size, are frequently pulled out of the mouth. This state lasts, in some cases, only about a fortnight, generally several months, and occasionally for years. But these persons uniformly fall into complete marasmus, as the digestive organs are totally deranged, and before death, they are often reduced to skeletons.

This variety occurred in *seven* of the *twenty-nine* cases now first described by Dr. Tartra; and he accounts plausibly enough for its having been seldom observed before, by supposing that when persons who had swallowed nitric acid had got the better of the primary symptoms, they were lost sight of, and the subsequent affection was not imputed to the proper cause.

Such, in general, is the progress when patients die of the secondary symptoms; but in the case of a female it was considerably different, as well as the appearance on dissection. The constipation was not very great; the expectoration did not last long, and the vomiting was rare; but a fixed pain at the bottom of the thorax, accompanied by difficulty of breathing and spitting of blood, deceived the medical attendants, who were not acquainted with the fact of her having drunk nitric acid. She was treated as if for pectoral complaints, and died in about sixty days after having swallowed the poison.

In this case alone, the body was not remarkably emaciated. The stomach was only a little contracted, and adhered in several places, especially to the liver and spleen. It contained a mass of solid blood, of a dark-red color, the size of a fist, moulded to the shape of the stomach, and covered by a very fine membrane, which seemed to be either the mucous membrane detached from the stomach in several places, or perhaps

a membrane of new formation. The intestinal canal, in this case, was of the usual size. Death seemed to have taken place before the gradual consumption had wasted the body.*

3. The third variety of termination is in imperfect recovery. This is also very frequent, and is characterized by the same train of symptoms with what we have now described, but very inferior in degree. The exfoliation of the œsophagus and stomach either takes place but once, or only a few times. A slow and progressive amendment insures the safety of the patient. But there still remains some complaint; obscure pains in the throat, and especially in the epigastric region; habitual constipation, occasional vomiting, and increased sensibility of the stomach, so that that organ can only support light nourishment and bland liquors. In short, they continue invalids during the rest of their lives; they are subject to repeated and even habitual indispositions, and sometimes to pain and insupportable heat of the stomach; but they are able to follow their occupations, and long survive their poisoning. Dr. Tartra has met with *eight* examples of this termination of the disease, in *fifty-six* cases.

4. The total disappearance of the symptoms produced by swallowing nitric acid, or complete and absolute recovery without leaving any consequences, is the last variety of termination. Of *fifty-six* cases, the recovery seemed to be complete in *twenty-one*.

One or two circumstances additional may be added, on the authority of Dr. Christison: The marks on the lips, skin, etc., where the acid has touched, are at first white, but shortly become, if from nitric acid, yellowish, and if from sulphuric, brownish. Again, there are undoubtedly some cases of poisoning, and particularly if by mistake, where the injury is confined to the gullet and neighboring parts. Dysphagia has thus happened for a time, and inflammation and spasm of the glottis and larynx may occur and cause a fatal result, without any affection of the stomach. Instances are quoted where the morbid appearances were confined to the above parts, and the

* An instructive case is given by Dr. Warren, in the American Journal Med. Science, July, 1850, p. 36.

stomach was healthy, and yet no doubt existed of the poisoning.*

One case, from its singularity, may be briefly stated in this place: Nitric acid was poured into the ear of a female, when intoxicated, by her husband. Severe pain ensued for two or three days; but this diminished gradually, and on the sixth day, a stringy, membranous slough came off from the ear, followed by copious hemorrhage. On the next day she lost the use of her right arm, and was extremely weak, but there was no stupor or vertigo. Every means was used to relieve the local disease, but the hemorrhage continued daily for almost a month; the right side became gradually paralytic, and she finally sunk, after great debility, in about three months after the injury. On dissection, the brain was healthy, except one dark spot on the dura mater, opposite the foramen auditorium internum. There was no effusion of serum, pus, or lymph, but a clot of blood of the size of a pea lying in the entrance of the meatus internus. The *right petrous bone* was, however, completely carious.†

Appearances on dissection. When the patients die of the primary effect of nitric acid, the external appearance of the body presents no alteration; every part is sound and natural, and exhibits in a certain degree the firmness and freshness of life. The epidermis of the margin of the lips has commonly an orange color, more or less deep. It seems burnt, and separates very easily. Sometimes yellow spots are discovered on the hands and other parts of the body, caused by the contact of nitric acid. A yellow fluid, in some cases very abundant,

* Christison, pp. 154, 157. Review of Ryland on diseases and injuries of the larynx, etc., in Edinburgh Med. and Surgical Journal, vol. xlix. p. 583. Dr. A. T. Thompson mentions a case that came under his own observation, of a child, which by mistake swallowed some strong sulphuric acid. It died almost immediately of suffocation; and, on dissection, the stomach and intestines were found healthy. None of the acid had reached them. Lancet, N. S., vol. xx. p. 385. The same or a similar case by Mr. Quain, in *ibid.*, vol. xix. p. 195.

† London Med. Gazette, vol xvii. p. 897. from the Dublin Medical Journal. The *vapor* of nitric acid, mixed with sulphuric acid, destroys life eleven hours after inhalation. (Lancet, April, 1854, p. 430.)

flows from the mouth and nostrils, and the belly is considerably distended with air.

The alimentary canal is remarkably affected. All the internal membrane of the mouth is burnt, and has sometimes a white, but more commonly a yellow color. It is separated in some places, and adheres to others. The teeth are often loose, and have a very marked yellow color at their crown. The mucous membrane of the pharynx exhibits the same change, or is in a state of inflammation, of a dirty-red color. The whole extent of the œsophagus is lined with a dense mass of a fine yellow color, dry on its surface, unctuous and greasy to the touch, and which seems to be formed both of the mucous membrane, altered in a particular manner, and of the albumen contained in the viscid fluid which exudes from the membrane of the œsophagus, solidified by the nitric acid.* This lining adheres in a very few points, and is easily detached from the other membranes of the œsophagus, which are brown and bloodshot.

"Occasionally the gullet is not affected at all, though both the mouth and stomach are severely injured; and an instance has even been published where the acid (in this instance nitric) left no trace of its passage downward, till near the pylorus.†

When the stomach is not perforated, it has commonly a considerable size. Externally, its membranes are slightly and partially inflamed, but very much toward the pylorus and

* Dr. Arnott, from a dissection made by him at the Middlesex Hospital, supposes that the yellow membrane found in the œsophagus is not the product of inflammation, but its cuticular covering changed by the direct action of the acid. In this case, the larynx had a thin, delicate layer of lymph, the result of inflammation. The patient survived thirty-six hours. (London Medical Gazette, vol. xii. p. 219.) Dr. Roupell gives a drawing of this case.

"The effects of corrosive liquids on the œsophagus," says Mr. Mayo, in his *Outlines of Physiology*, "is to produce, in the lowest degree, separation of the cuticle; in a higher degree, effusion of lymph; in the highest, sloughing of the lining membrane to a greater or less extent, which, being thrown off, leaves a granulating surface, that, cicatrizing, contracts and narrows the canal, establishing permanent and fatal constriction." Quoted by Dr. Wm. Thomson, in *Edinburgh Med. and Surg. Journal*, vol. lxxvi. p. 128.

† Christison, third edition, p. 166. This case is mentioned in *Chapman's Journal*, N. S., vol. iv. p. 410, as occurring at La Charité.

beginning of the duodenum. Its color is faded, livid, of a yellowish green, with large gangrenous spots. . It adheres everywhere to the neighboring parts, the diaphragm, liver, spleen, and transverse arch of the colon, by means of concrete lymphatic exudation. Its sides, which are thin and yellow in some places, and thick and black in others, exhibit networks of dilated blood-vessels, filled with black coagulated blood. Often there are several points of the stomach dissolved and ready to burst with the slightest touch. It contains a great quantity of gas, which has a particular smell, resembling that of bitter almonds. Most commonly, it also contains a great quantity of yellow matter, having the consistence of pap, in which there are flocculi, or small masses resembling tallow, which, however, may be the cheesy part of the milk drunk by the patient, decomposed in the stomach. Its sides are coated internally with a thick grained paste of a yellowish-green color, composed, according to all appearance, of the internal membrane, disorganized and dissolved, and of coagulated albumen. Almost always the substance of the stomach is swelled in some places, and deeply marked with black, without being dissolved. This effect is most remarkable at the great end, into which the acid seems to fall by its weight. The rugæ of the stomach are very brown, and are reduced to mucilage. They are easily removed by the finger from the nervous coat, which, by reason of its whiteness, often appears in a great measure sound. The small end is affected with many deep spots of gangrene, and the pylorus is much contracted.

The duodenum internally, especially at its two curvatures, presents the same kind of change as the stomach. Its sides, as well as those of the jejunum, are marked with yellow, slightly greenish. They are also lined with a very thick orange crust, and the villous membrane is dissolved and destroyed. These phenomena have less intensity in proportion as the part is more distant from the stomach.

The surface of all the abdominal viscera is commonly very much inflamed. The peritoneum is thickened, hard, of a dirty-red, covered with albuminous layers, which unite, by numerous adhesions, all the viscera, and especially the folds of the intestines, as it were, into a single mass.

The thoracic surface of the diaphragm and of the inferior lobes of the lungs is covered with a very solid layer of albumen, of a whitish color.

A bloody liquid is effused into the abdomen; and there is also a small quantity in the chest.*

The urinary bladder contains no urine, although the patients have not discharged any. The large intestines are usually filled with very hard fæces.

In most cases where the stomach is perforated, its bulk is very small; in other respects it is the same. The holes commonly occur in the large and small extremities; their form is circular and their edges thin, as if dissolved. We then find in the abdomen an enormous effusion of a thick yellow liquid, containing many white flocculi, and resembling the fluid with which the stomach is filled when it is not perforated. The greatest distention always accompanies this state of the belly. The alteration and disorganization are carried to the highest degree. The surface of the abdominal viscera seems to have suffered the direct action of very dilute nitric acid. It is greasy and unctuous to the touch, and almost everywhere spotted with yellow.

The appearances upon dissection of those who die of the secondary effects are entirely different from those now described. It would be difficult to find an example of greater emaciation, more advanced consumption, or disgusting form. Nothing is equal to the degree of withering, drying up, and decrepitude of the whole organs. Their color is faded; the internal cavities do not contain the usual serum; the cellular and muscular systems are almost annihilated; the bones become dry, as in persons of advanced age, and break with wonderful facility. But these changes are general and secondary, and depend upon local organic derangement of the alimentary tube. The stomach and whole intestinal canal are contracted to an

* Dr. Hertwig is said to have performed numerous experiments with the mineral acids, and also the carbonic, acetic, and tartaric, on animals and birds; and the effect of all except the nitric is to give a dark color to the blood within the arteries and veins. (*American Journal of Medical Sciences*, vol. xi. p. 501.)

extremely small size, so that they could be contained in the hollow of the hand.* The intestines are not larger than the little finger, sometimes not exceeding a thick writing quill. Their coats are very thick, their cavity almost obliterated, and containing only a little mucosity. In general, all the parts touched by the poison are contracted, and as if obliterated. The stomach, which often resembles a portion of a small intestine, appears sound externally, and only presents some adhesion to the diaphragm, liver, and spleen; internally, the most remarkable change is the contraction of the pylorus, the passage through which will scarcely admit a probe; and the membranes of the stomach itself are so thickened and compacted around it that they have lost all their natural suppleness.

On the internal surface there are irregular spots, or rather smooth and red places, which seem to be covered with a regenerated mucous membrane less villous than that which has been destroyed by the action of the acid. These cicatrices are especially large and numerous in the great end of the stomach, and around the circumference of the pylorus. There are also commonly some at the cardia, as well as in the lower half, and even in the whole of the œsophagus and pharynx. The adhesions of the stomach with the neighboring parts are sometimes simple, but most commonly they are very remarkable. Viewed from the inside of the stomach, they form irregular circular depressions where the whole thickness of the coat is evidently wanting; so that in attempting to destroy these adhesions, we find that there are in fact so many holes through the substance of the stomach, which are plugged up by the adhesions of the neighboring viscera.

Chemical proofs. When concentrated, its odor is peculiar. It acts also on copper, lead, or tin, disengaging nitric oxide gas, which is converted into nitrous acid gas on coming in contact with the atmosphere. [With hydrochloric acid it constitutes

* In a case at La Charité, where the patient survived an intense gastritis, but lingered on, with pain and frequent vomitings, after taking food, together with symptoms of dropsy, until three months after taking the poison, the pylorus was found so contracted that its diameter did not exceed a line or two. There were also several cicatrices of ulcers. (Medico-Chirurgical Review, vol. xxxii. p. 552.)

the *aqua regia*, dissolving gold-leaf.] Other tests have been suggested and claimed as peculiar, but they have scarcely stood the test of investigation. Thus morphine was said to be changed in a few seconds to an orange-red color, and soon after to form a bright red-color.* But Dr. R. D. Thomson stated to the British Association, in September, 1840, that pure morphine had no action on nitric acid, and that it is alone the resin which generally accompanies that alkaloid which produces the characteristic yellow color. Again, Berthemot advised a mixture of free sulphuric acid, with a few drops of the liquor supposed to contain the nitric acid, and to this the addition of brucine. If nitric acid was present, there would be, first, a red color, and presently a yellow color.† But very soon Mr. Nevins, although granting the delicacy of this test, ascertained that iodic acid, and even chloric acid, if treated in the same way, would produce similar results.‡ About one process, however, with which all chemical experimenters are familiar, there can be no mistake, whether the liquid be concentrated or diluted; and that is, to add a few drops of a diluted solution of caustic potash. Nitrate of potash is immediately formed. The solution may be evaporated to dryness, and then deflagrated; or some bibulous paper may be dipped in it and tested in the same way.

Process for stains. Boil the substance stained in distilled water several times in succession; ascertain its acidity, and then render it feebly alkaline, by adding a few drops of a diluted solution of caustic potash. Evaporate this to dryness, or test with paper, as above.

Process for compound mixtures, as in the contents of the stomach. Neutralize them with potash, and then filter and evaporate. Crystals of nitrate of potash will be formed, which may be decomposed by sulphuric acid. But often the quantity of acid present is not sufficient to produce this result. In this instance,

* Dr. O'Shaughnessy, *Lancet*, N. S., vol. vi. p. 330. Dr. Liebig's test of the sulphate of indigo has been shown by Dr. O'Shaughnessy to be altogether fallacious. Several other acids, besides four or five salts, equally possess the power of decolorizing it. (*Ibid.*, pp. 330, 452; and also vol. x. p. 302.)

† *Pharmaceutical Journal*, vol. ii. p. 600.

‡ *Pharmaceutical Journal*, vol. iv. p. 414.

Dr. O'Shaughnessy recommends a slow process of filtration through a loosely twisted cord of filtering paper, about eight inches long. The drops that pass out should be received in a proper vessel, and the whole covered with a bell-glass to prevent evaporation. In a day or two they will probably be so pure as to yield, by evaporation, crystals of nitre, which, when decomposed by sulphuric acid, will allow the morphine to produce its effect. If this process be not effectual to remove all organic matters, Dr. Christison directs that acetate of silver be added to the product of evaporation. This throws down hydrochloric acid, and with it several organic principles. The residue may be filtered and evaporated, and treated as above.*

Devergie advises that these compound mixtures, after being properly boiled, be treated with gaseous chlorine, so as to separate as great a portion as possible of the animal matter. After the nitrate of potash is formed as above, by the addition of *bicarbonate* of potash, decompose with sulphuric acid, and then test with the protosulphate of iron. The nitrous acid turns this black.†

In order to discriminate between the nature of the yellow spots that are observed in the intestinal tube, and which are equally the result of nitric acid, iodine, and the bile, Barruel directs that a weak solution of caustic potash be applied to them. If owing to bile, there will be no change; if to iodine, the spot immediately disappears, and the tissue returns to its natural color; but if to nitric acid, the color will become stronger and of an orange yellow.‡

* Christison, pp. 144 to 150; *Lancet*, N. S., vol. vi. p. 840, vol. vii. p. 610.

† Devergie, vol. ii. pp. 590, 596. I find the following delicate process recommended by De Richemont; it certainly deserves a trial: "To detect the presence of nitric acid, add to a small quantity of sulphuric acid the solution to be examined, in such a proportion that the quantity added shall equal three-fourths of the bulk of the acid. When the mixture has become cool, drop in a concentrated solution of protosulphate of iron, which, if any nitric acid is present, decomposes it, causing the evolution of nitric oxide, which produce a rose-red or purple tint. This mode of operating will allow us to detect one part of nitric acid in 24,000 of water." (*London and Edin. Phil. Mag.*, vol. xiii. p. 393.)

‡ *Annales d'Hygiène*, vol. i. p. 278. A French case of supposed poisoning

Antidotes. The same substances that were recommended in noticing sulphuric acid are proper in this case. Chalk, magnesia, or soap and water, should be immediately used. If, however, any form of lime has been given as the immediate antidote, it may be well to remember that the nitrate of lime is hardly of itself innocuous; and it is, hence, necessary to follow its use with draughts of broth or milk, containing the phosphate of soda in solution. An insoluble phosphate of lime is thus produced.

The alkaline carbonates are not to be used, being themselves possessed of corrosive properties.*

Muriatic (hydrochloric) acid. I have met with the narratives of six cases in which this was taken: death followed in five of them.

A man, aged thirty-seven, swallowed an ounce and a half by mistake. It was succeeded by extreme restlessness, violent pain in the stomach, a burning skin, small, hard pulse, a fiery red tongue, blackish lips, hiccough, and an effort to vomit. Antidotes were given, and in the night he vomited yellow matter. In the morning, however, the skin was cold and clammy, delirium was constantly present, the pulse extremely quick, the pain very violent, and he died at three in the afternoon.†

by nitric acid is given in *Edinburgh Medical and Surgical Journal*, vol. xxxiv. p. 212.

I subjoin a notice of another test, the hydrargyro-cyanide of iodide of potassium, for the reason stated below. It is formed by mixing cyanuret of mercury and iodide of potassium together in their equivalent proportions, and dissolving the salt in small quantities of warm water, from which, on cooling, it is deposited in beautiful plates.

If one of its scaly crystals be put into most of the acids, as the sulphuric, muriatic, hydrofluoric, chromic, phosphoric, and the common vegetable acids, it immediately becomes of a beautiful red, being changed into biniodide of mercury; but in concentrated nitric acid, of the specific gravity 1.4 to 1.5, the scale almost instantly becomes black from the liberation of iodine. This effect is visible upon a very small proportion of the salt. (*Edinburgh Monthly Journal of Med. Science*, vol. i. p. 601.) If there be any value in this test, the credit of it is due to Professor Bailey, of West Point. (See *Silliman's Journal*, 1839.)

* Christison, p. 165; *Lancet*, N. S., vol. vii. p. 836.

† Orfila's *Toxicology*, third edition, vol. i. p. 133. Case by Dr. Serres.

In another case, two ounces had been taken, which was followed by vomiting. Carbonate of soda and magnesia, with leeches to the throat, were prescribed with some relief; but on the fourth day the vomiting returned, the throat continued sore, the tongue was swollen, and with these symptoms he sunk eight days after taking the poison.*

Dr. Toothaker relates a case of recovery. An ounce of the officinal muriatic acid had been swallowed by mistake. It was succeeded by violent burning of the mouth and fauces, a sense of suffocation and spasms. Olive oil was given, followed by milk and water, thickened with calcined magnesia. Copious vomiting ensued. An emetic was next administered, and this again followed by magnesia. The strength was greatly reduced, and the extremities so cold as to require the application of sinapisms. The next day there was pain and costiveness, but these were relieved by a dose of castor oil. After this the patient gradually recovered, although not without reminiscences of the corrosive substance which he had taken.†

Appearances on dissection. In the French case the lips were black, the tongue brown, thick, hard, and dry; the pharynx and œsophagus of a purple-red, and excoriated in several places; the stomach was thickened and inflamed externally, and its mucous membrane could be detached in strips with the slightest touch, and was covered with gangrenous patches; the duodenum was also slightly thickened.

In the second case, the larynx, bronchiæ, and left lung were inflamed, and its mucous coat had sloughed in some places, and in others was thickened. The coats of the stomach were inflamed, and in several places had sloughed, the shreds hanging loose. The duodenum was inflamed, but not gangrenous.

* London Med. Gazette, vol. xix. p. 349. The remaining fatal cases are to be found in The Lancet, N. S., vol. xxv. p. 899; London Med. Gazette, vol. xxv. p. 285, case by Mr. Quekett. Death occurred in fifteen hours, and there was blackening and extensive erosion. Howship, in his work on Affections of the Stomach, relates a case fatal in three days, and the stomach was thickened and pulpy with high inflammation. Additional cases may be found in Galtier's Toxicology, vol. ii. p. 217; Annales d'Hygiène, January, 1858, p. 209.

† Boston Med. and Surgical Journal, vol. xv. p. 270.

The tests are thus given by Dr. Christison: In its concentrated state, it is known by its yellow fumes and its peculiar odor. Bring a rod dipped in ammonia near another dipped in the acid, and a white vapor will arise. [A conclusive test is obtained by boiling, in contact with powdered black oxide of manganese, when, if concentrated hydrochloric acid is present, chlorine will be evolved.] When diluted, add nitrate of silver, and a dense white precipitate, the chloride of silver, is produced. This latter salt is distinguished from all other white salts of silver, by drying and boiling it in a tube. It fuses, but, unlike the others, remains undecomposed at a red heat. Again, the other white insoluble salts of silver, which are dissolved by ammonia, are soluble in an excess of nitric acid; but the chloride, if treated in the same way, is not redissolved by an excess of nitric acid.*

There is an inherent difficulty, however, in proving poisoning with this acid by chemical tests, since it has been found as a natural or diseased product in the stomach by several very accurate chemists.†

ACETIC ACID. This substance, in its concentrated form, has been found to be a poison. An ounce of pyroligneous vinegar or acid, when given to a dog, whose œsophagus was tied, caused death in five, seven, or nine hours, preceded by efforts to vomit, great suffering, and weakness. An ounce of the concentrated acid occasioned death in an hour and a quarter. On dissection, in all these cases, the stomach contained brownish-black blood; the villous coat was blackish, and the subjacent tissue injected. Erosions and even perforations were not uncommon when the strong acid was used.‡

Even common vinegar, in large quantities, was found destructive to dogs, when vomiting was prevented.

A medico-legal case is related by Orfila: A female, aged nineteen, died in one of the streets of Paris. All the informa-

* Christison, p. 151; Lancet, N. S., vol. vii. p. 193. Hydrocyanic acid will also give a white precipitate with nitrate of silver, but this is soluble in nitric acid at the boiling temperature, without *changing its color*. (Devergie, vol. ii. p. 611.)

† Bulletin de l'Acad. R. de Médecine, vol. iii. pp. 252, 265, 579.

‡ Annales d'Hygiène, vol. vi. p. 159.

tion that could be obtained concerning her was, that she appeared as one drunk, moaned incessantly, but passed on, having asked her way. In a short time she was found lying in agony, and, after strong convulsions, died. On dissection, the mucous membrane of the tongue and œsophagus was seen of a leathery consistence, wrinkled and brown. The stomach contained eight ounces of a fluid which effervesced. Its mucous membrane was nowhere destroyed, but some red or dark spots were seen near to the pylorus, and many of its small glands were hardened. Coagulated blood was found in the submucous cellular tissue.

The fluid found in the stomach was filtered, and a small quantity of carbonate of lime added to it; but no effervescence followed, although a test-paper was slightly reddened. Nitrate of silver and muriate of barytes each demonstrated the presence of the muriatic and sulphuric acids, or their salts.

The fluid was now put in a retort, with a receiver attached, and the retort immersed in a concentrated solution of muriate of lime. This last was heated to boiling, and the fluid in the retort was by this means evaporated to dryness, without any charring of the organic matter. The fluid distilled into the receiver was now tested for sulphuric and muriatic acids; and they being absent, carbonate of potash was added to neutralization. This was then evaporated to dryness; sulphuric acid was added, and by redistilling, a notable quantity of strong and pure acetic acid was procured.*

In its pure state, acetic acid is known by its odor and its forming with potash a deliquescent salt.

The antidote, according to Orfila, is magnesia.

OXALIC ACID. Numerous deaths have occurred in England within a few years from the administration of this substance. It was generally taken accidentally, being mistaken for the sulphate of magnesia, a salt which it resembles in external character. The facility of the occurrence of these accidents is

* *Annales d'Hygiène.* Dr. David relates a case in the *British American Journal of Med. Sciences* of September, 1847, of a female who in despair swallowed nearly a quart bowl full of common vinegar. She had many of the ordinary symptoms of poisoning, but recovered.

increased from the circumstance that it is frequently applied to several domestic purposes, such as the cleaning of leather, and the removal of iron-mold and ink-spots. There are not, however, wanting instances in which this substance has been willfully taken to destroy life.

The cases substantiating the deleterious effects of oxalic acid are contained in the leading periodical publications of the day; and from a comparison of these I am enabled to present the following accounts of its effects.*

When the solution is strong, (and this is usually the case, from its being mistaken for Epsom salts,) its corrosive nature is such as to excoriate the mouth in a violent manner. A young man purchased some for the purpose of committing suicide, but its extreme pungency made him hesitate in swallowing it while it was yet in his mouth; his life was thus preserved, but a most dreadful excoriation of the tongue, mouth,

* The most elaborate and valuable article on this subject is a paper on poisoning by oxalic acid, published by Professor Christison and Dr. Coindet, in the *Edinburgh Medical and Surgical Journal*, vol. xix. p. 163. Its effects on animals, and the tests for its detection, are fully considered. Besides this, the following cases have been published:—

1. Case by Mr. Royston, *London Medical Repository*, vol. i. p. 382. This was the first, and it occurred in 1814. 2. By Mr. Roberts, *ibid.*, vol. iii. p. 380. 3. By Mr. George Johnson, *ibid.*, vol. vi. p. 474. 4. By Mr. Williams, *ibid.*, vol. xi. p. 20. 5. By Dr. Smith, *ibid.*, vol. xii. p. 18. 6, 7. Two cases in *Edinburgh Medical and Surgical Journal*, vol. xiii. p. 249. 8. By Mr. Fraser, *ibid.*, vol. xiv. p. 607. 9. Case of Michael Dillon, in *Cooper's Tracts*, p. 449, from a London paper. 10. Case by Mr. Hebb, *London Med. Repository*, vol. xxii. p. 475. 11. By Mr. Mollan, *Dublin Hospital Reports*, vol. ii. p. 329. 12. A case at St. George's Hospital, *Lancet*, N. S., vol. i. p. 447. 13. A case communicated to Dr. Christison, by Dr. Arrowsmith, of Coventry. 14. By Dr. Dancy. Partial recovery in a female, but her health gradually sunk, after a few months, from extreme irritability of the stomach, so that the blandest liquids caused violent spasms and convulsions. *Transylvania Journal of Medicine*, vol. viii. p. 594. 15. By Mr. Taylor, *Guy's Hospital Reports*, vol. iii. p. 353. 16. By Mr. Howship, fatal on the fifth day; quoted in *Medical Times*, October 9, 1841. 17. By Dr. Chas. T. Jackson, *Boston Med. and Surgical Journal*, vol. xxx. p. 17. 18. By Dr. Hazeltine, *ibid.*, vol. xxxi. p. 39.

Dr. Christison also refers to Dr. Percy's *Inaugural Dissertation*, for additional cases.

Nearly all of these (with, I believe, only two exceptions,) proved fatal. There are several cases of recovery, which I shall presently mention.

and gums was the consequence.* So also in Mr. Fraser's case, the tongue was greatly swollen, and had the appearance of being scalded. I do not, however, find any notice of this in other cases, probably because the solution was diluted, or (which is more likely) taken down at a single swallow.

Death ensued with great rapidity—in forty minutes in one case, in twenty minutes in Mr. Taylor's, and in ten minutes in two others. A few hours (prolonged in Mr. Hebb's and Dr. Arrowsmith's to thirteen) is generally the term. The patient under the care of Mr. Fraser, however, survived several days, and finally died of the secondary effects. As this case is somewhat peculiar, I shall notice it particularly hereafter.

The earliest symptom, in the absence of the one mentioned above, is burning pain in the stomach; and this occurs early, if the dose be large; but if it be small, some hours may elapse. Excessive vomiting of a dark-colored or sanguinolent fluid soon follows, and commonly continues until near death. There are, however, exceptions to this. Some have not vomited at all, and Dr. Christison observes that this is most apt to happen when the poison has been taken much diluted.

When life is prolonged for a few hours, pain in the bowels and purging follow, and the *faeces* are mixed with blood. In Mr. Hebb's case there was an involuntary discharge.

Along with these there is a sunken countenance, and the pulse is almost imperceptible at the wrist, indicating the nearness of death.

In Dr. Arrowsmith's case two peculiar symptoms occurred. One was a deep-red mottled appearance of the skin in circular patches; and the other, the poisoning and death of leeches applied to the stomach. This was six hours after the poison had been taken: and, although healthy, and fastening immediately, "yet they did not seem to fill; and on touching one, it felt hard, and immediately fell off, motionless and dead. The others were all in the same state; they had all bitten, and the marks were conspicuous, but they had drawn scarcely any blood."†

* London Medical Repository, vol. vii. p. 523.

† Christison, p. 198.

In Dr. Chas. T. Jackson's case, a man aged thirty years, took by mistake nearly one ounce of crystallized oxalic acid (477 grains) dissolved in warm water. He survived nine days; vomiting was present for several days, and the urine was suppressed at first, and afterwards passed in small quantity. At last there was an inability to pass it, and it was necessary to use the catheter. Dr. Jackson also states that the skin of the face, head, and nates was covered with red spots or petechiæ, appearing as if bespattered with blood. He sunk gradually, and died without a struggle.

On dissection, the stomach was found to be remarkably corrugated, and its mucous membrane very bright red, thickened and soft, with numerous small ulcers in it; so also the duodenum. Jejunum and ileum congested with blood. The mucous membrane of the large intestines was healthy. Heart nearly empty of blood; lungs contained an unusual filtration of serum, but otherwise healthy.

In the case related by Mr. Fraser, an individual took half an ounce of oxalic acid in solution, instead of salts. He instantly became conscious of the mistake, from perceiving the acid taste. Pain and vomiting ensued, and although they were mitigated in some degree by alkaline remedies, yet they recurred with violence. Spasms, impeded respiration, and general numbness were complained of; the pulse was scarcely perceptible at the wrists or temples; the extremities were cold, and the matter vomited became tinged with blood; after a short time he brought up a large quantity of blood. Diluents were freely administered, together with anodynes, and his situation gradually became more tolerable. Numbness, however, occasionally occurred, and was relieved by warm applications and a drink of sago and wine. On the second day vomiting, retching, spasms, and singultus supervened; the pulse was nearly 100, and feeble, and numbness and chillness of the feet were present. A repetition of previous remedies gradually moderated these, but the hiccough continued for several days. On the sixth day he felt himself so well as (contrary to directions) to ride out in a gig. After this, debility came on gradually; an eruption appeared over the whole body, and hiccough was occasionally present. He retained his senses until the day

before his death, and complained often on swallowing any article which was not perfectly bland. He expired fourteen days after taking the poison, in a state of perfect exhaustion.

Some cases of recovery are referred to in the note below.* In all these, great irritation and pain in the stomach, and sometimes also in the throat, were constant and early symptoms; spontaneous vomiting is only mentioned in a few instances; but in several more or less of gastric irritation remained, which required laxatives to remove it.

Appearances on dissection. These indicate the presence of a powerful acid. In Mr. Royston's case, where the subject was a female, who died in forty minutes, the villous coat of the stomach was injected with blood, and florid over its whole surface; patches of an extraordinary intensity were also noticed. In other cases this coat was entirely corroded, and indeed the stomach perforated, so that its contents had escaped

* Dr. Scott, of Cupar-Fife. Dose, a wineglass of the solution, containing a drachm of the acid. (Edinburgh Medical and Surgical Journal, vol. xxiv. p. 67.)

Prof. Syme. Two drachms in solution. (Ibid., vol. xlv. p. 27.)

A case at Guy's Hospital. Half an ounce—suicide; vomiting occurred soon; but the stomach-pump was immediately used, and magnesia exhibited. (London Medical Gazette, vol. v. p. 704.)

A case at the Worcester Infirmary, England. Half an ounce by mistake; cured by chalk, castor oil, etc. (Midland Medical and Surgical Reporter, vol. iii. p. 152.)

Case by Dr. Tolefree, of New York. A quarter of an ounce by mistake. Emetics. (Boston Medical and Surgical Journal, vol. xii. p. 158.)

Case by Mr. Boyrenson, at the London Hospital. British Annals of Medicine, vol. i. p. 716, cured by carbonate of lime, leeches, etc.

Case by Mr. Babington. Two scruples, in combination with carbonate of soda. The patient recovered, but suffered much from weakness and other symptoms indicative of great depression of the nervous and circulating systems. (London Med. Gazette, vol. xxvii. p. 870.)

Case by R. H. Semple. A female took a quarter of an ounce. Relieved by lime-water and carbonate of magnesia. (Lancet, N. S., vol. xxviii. p. 187.)

By Dr. Todd. Two cases relieved by free use of chalk mixture, and an emetic subsequently. (Lancet, N. S., vol. xxix. p. 697; vol. xxx. p. 145.)

By Mr. Howship. Relieved by lime-water, venesection, etc. (Quoted in Medical Times, October 9, 1841.)

By Mr. Tapson. Relieved by large draughts of chalk and water, and subsequently the remedies for gastritis. (London Med. Gazette, vol. xxxi. p. 491.)

into the cavity of the abdomen. The œsophagus of one individual was so injured that its cuticular coat peeled off with the slightest effort.*

The intestines sometimes partook in the inflammation and contraction, and at other times not; but the viscera of the thorax, and the brain, do not appear to have been diseased in those cases where their examination is noticed.†

In Mr. Hebb's case, the mucous membrane of the throat and gullet appeared as if it had been scalded, and could be easily separated. The stomach contained a pint of thick, dark-colored fluid, probably blood changed by the acid: its inner coat was pulpy, in many points black, and in others highly inflamed. The same was seen in the intestines. The lining membrane of the trachea and lungs was also very red.

In Mr. Taylor's case, the mucous membrane of the stomach appeared pale and softened, and entirely free from rugæ; while in some parts of that organ, and especially toward the lesser curvature, the vessels of the mucous membrane were seen ramifying, and filled with dark-colored blood, which appeared solidified within them. The whole has thus an arborescent appearance. The mucous membrane of the œsophagus was pale, as if boiled in water, and here and there abraded, while the blood-vessels exhibited similar appearances as in the stomach. The duodenum and jejunum were slightly inflamed. The blood throughout the cavities was universally liquid and dark colored. The lungs were engorged, and the right cavities of the heart collapsed and empty.

In the instance reported by Mr. Fraser, on dissection, the stomach and a small portion of the intestines presented the marks of inflammation; the villous coat was completely destroyed, and this abrasion extended upwards throughout the whole of the œsophagus, exposing the muscular coat. In some

* "A quantity of dark-colored fluid, resembling coffee-grounds, and probably consisting of extravasated blood altered by the poison, was generally found in the stomach." (Christison and Coindet.)

† In the case of a dog, which died in a quarter of an hour after a drachm of the acid in solution had been injected into the stomach, Dr. Hodgkin found the whole extent of the mucous membrane of the intestinal canal apparently thickened, owing to a thick opaque white secretion deposited on it.

parts the villous coat seemed entire, but, on examination, it was found to be soft, and easily rubbed off with the finger or sponge. The muscular coat of the stomach and œsophagus was much thickened, highly injected, and exhibited a dark gangrenous appearance. No perforation of the stomach was observable. The small intestines exhibited similar appearances, but partially, and in a lighter degree. The other viscera were healthy.

It is worthy of remark, that there is one fatal case of a girl dying in *thirty minutes* after swallowing an ounce, in which there were no morbid appearances whatever to be seen in any part of the alimentary canal. Orfila, however, states expressly that if the stomach be examined soon after death, it will be found but little corroded, in comparison to what it will be, if not opened until a day or two afterwards.*

Effects on animals. On this point we have the experiments of Dr. A. T. Thomson, and those of Drs. Christison and Coindet. The former gentleman produced death in a very few minutes, by introducing from ten grains to half a drachm into the stomachs of rabbits and dogs. Convulsive movements generally preceded the fatal termination, and on dissection, the stomach was found very rotten, diaphanous and pulpy to the touch, and its blood-vessels enlarged and very black; the mucus contained in it was coagulated. The lungs were inflamed, and the blood found in the lungs, heart, abdomen, and the frothy fluid found in the bronchial cells, showed traces of an acid. The œsophagus and pharynx were healthy.†

* *Lçons*, third edition, vol. iii. p. 55. In Mr. Howship's case the upper and lower parts of the œsophagus were most affected by inflammation, and were covered with fibrin. The stomach, though inflamed, exhibited no erosion.

In a case by Dr. Letheby, the female, aged twenty-two, had poisoned herself, and was found dead. The tissue of the stomach was so softened that it could scarcely be handled without tearing, and at the cardiac end it was soft and pulpy, with numerous perforations. Dr. Christison mentions but one case of corrosion and perforation, and Mr. Taylor does not deem it common. (*Lancet*, October 19, 1844.)

† *London Med. Repertory*, vol. iii. p. 383. The tetanic convulsions witnessed in quadrupeds do not seem to occur in the human species. *Lancet*, N. S., vol. xx. p. 390.

In the experiments of Christison and Coindet, the œsophagus was tied in every instance, and the violence of the efforts to vomit was directly in proportion to the quantity of the poison. Death, however, always succeeded after a short interval. On dissection, the stomach was found filled with the dark-colored fluid already noticed, when speaking of the examinations of the human subject, and which is evidently extravasated blood acted on by the acid. The internal membrane of the stomach was always of a deep cherry-red color, and generally streaked with lines of black, granular extravasation. The degree of corrosion induced appears to depend on the strength of the acid.

When portions of a dead stomach were submitted to the action of a saturated solution, the mucous epidermis separated, and appeared thickened and brittle. After some hours, the villous coat was also acted upon, and in two days it was brittle and easily scraped off, and the other tunics were softened, swollen and translucent. It thus evidently exerts a powerful chemical action on the organs concerned.

These observers also noticed that a small quantity of acid, when diluted, destroys an animal much sooner than when concentrated; and, on dissection, no unnatural appearance whatever could be detected in the stomach, excepting a slight cineritious tint of the mucous epidermis.

The result drawn from their numerous experiments is, that oxalic acid, in most circumstances, acts through the medium of absorption. They could not however detect its presence in any of the fluids.*

Rr. Roupell, in his experiments on dogs with this acid, has confirmed the above results.† The stomach, on dissection, had the hour-glass contraction.

Tests. Oxalic acid might be mistaken for two other vegetable acids, the tartaric and citric acids; but Drs. Christison and Coindet have shown that these can be given to animals in large quantities without any inconvenient result.‡ From a

* Edinburgh Med. and Surgical Journal, vol. xix. pp. 163 to 186.

† Illustrations of the effects of poisons, with drawings.

‡ Edinburgh Medical and Surgical Journal, vol. xix. pp. 185, 337.

similarity in the external appearance, it has most commonly been confounded with sulphate of magnesia, and hence many fatal mistakes have happened.

(a.) Taste the suspected substance; if it be oxalic acid, it is very sour; if Epsom salts, very bitter and saline.

(b.) Pour some water over the suspected crystals; if it be oxalic acid, its particles explode with a sharp, crackling sound, and disperse in every direction.

(c.) A little writing-ink dropped on the crystal will become reddish brown, forming oxalate of iron. Epsom salts are not changed.*

(d.) Litmus and blue sugar-loaf paper are reddened by the acid.

(e.) Ammonia, if the solution of the acid be sufficiently concentrated, will produce a radiated crystallization, as the oxalate of ammonia formed is much more soluble than the acid itself. Dr. O'Shaughnessy states that this property distinguishes it from every other acid.†

The following tests we owe to the suggestions of Drs. Christison and Coindet, and they may be used on all suspected fluids found in the stomach, or vomited:—

(f.) Decolorize the fluid, if necessary, with chlorine. The hydrochlorate of lime, if the solution contains oxalic acid or oxalate of lime, will throw down an insoluble oxalate of lime; but it also precipitates with the carbonates, sulphates, phosphates, etc. This, then, is to be distinguished by the following experiments: The nitric acid will not take up the sulphate of lime, but a few drops of it dissolves the oxalate. The hydrochloric (muriatic) acid will not dissolve the oxalate, unless in very large quantity; while two or three drops will take up the carbonate, phosphate, tartrate, or citrate.

(g.) Decolorize as before, and add sulphate of copper. It precipitates oxalic acid bluish white, and the oxalates pale blue. The only objection to this is, that it precipitates the carbonates and throws down the phosphoric acid, whether free

* Quarterly Journal of Foreign Medicine and Surgery, vol. v. p. 152.

† Dr. O'Shaughnessy, Lancet, N. S., vol. ii. p. 196.

or combined. The muriatic acid must be here again used as above.

(h.) Nitrate of silver gives a heavy white precipitate with oxalic acid, and still better with the oxalates; and this precipitate, when dried and heated over a candle, becomes brown on the edge, then of a sudden fulminates faintly, and is all dispersed in white fumes. This is deemed a very delicate test, as from a quarter of a grain dissolved in 4000 parts of water, the experiments procured enough of the powder to show its fulmination twice. [The sulphate of lime in solution produces, with oxalic acid, a white precipitate; the oxalate of lime soluble in nitric acid, but not in tartaric or acetic acids.]

These tests are very little influenced by the presence of such animal matter as may exist in the suspected fluid, after boiling and filtration. The chief animal principle then present is gelatine, and neither the hydrochlorate of lime, sulphate of copper, or nitrate of silver precipitate it alone. They, therefore, and especially the two first, will not be affected by its presence; but when it occurs in a very large proportion, it suspends the action of nitrate of silver.

As, however, magnesia and chalk are the proper antidotes for oxalic acid, it is possible their oxalates may be formed and the proofs of the poison must be sought for either in the solid contents of the stomach or the solid matter vomited. In such cases the following are the directions given by Dr. Christison:—

If they have been given, let the mixture remain at rest for some time. Then pour off the supernatant fluid, which, if acid, may be tested as above. Dissolve the mass that remains in pure water, to a sufficiently thin consistence; add to this one-twentieth of its weight of carbonate of potash, and boil it gently for two hours. The result of this will be an oxalate of potash in solution. Filter; then render it faintly acidulous with nitric acid; then filter again, and render it faintly alkaline with carbonate of potash. Filter a third time. The object in these repeated operations is to throw down the animal matter.

A solution of acetate of lead must now be added as long as any precipitate is formed, and this should be washed and dried. Then rub it carefully with a little water, in a mortar, and

transmit through it a current of sulphuretted hydrogen for four hours.* Filter and boil the sulphuret of lead that has been produced. The oxalic acid will be set free, and is found in the solution tolerably pure.

Dr. Christison was enabled by this process to detect one grain of oxalic acid, mixed with a decoction of an ounce of beef and six ounces of water.

Oxalate of lime has been found by M. Henry, of Paris, in the root of rhubarb. If, therefore, that salt should be detected, it may be necessary to inquire whether rhubarb has been recently administered.†

Antidotes. Death is generally so sudden in these cases that but little can be done. Emetics, however, should be immediately given, but not to be aided in the usual way with warm diluents, since dilution accelerates the operation of the poison.

We owe to Dr. Thomson the recommendation of the use of a mixture of chalk and water, to be given as soon as possible. Oxalate of lime will thus be formed in the stomach.‡ Magnesia is advisable, and the solution of the bicarbonate, invented by Dr. Murray, of Belfast, is particularly commended, as it precipitates the acid itself, and all its soluble combinations.§ Both of these substances (chalk and magnesia) have been given with striking advantage.

The alkalies should not be given, as Christison and Coindet found death to follow in animals from the exhibition of the oxalates of potash and ammonia in a few minutes. "They do not corrode; they hardly irritate, but they produce tetanus and coma, like the diluted acid."||

Should the patient be so fortunate as to recover from the immediate effects, the proper means for removing gastric irri-

* Mr. Taylor prefers treating the oxalate of lead, obtained as above, by boiling it with sulphuric acid, instead of using sulphuretted hydrogen. The sulphate of lead is deposited; the acid liquor is cautiously neutralized with ammonia, and to a portion of it a solution of *sulphate of lime* is added. A fine white precipitate slowly subsides, and this is easily dissolved by a few drops of nitric acid. The existence of oxalate of lime is thus proved.

† Christison, p. 188, etc.; *Lancet*, N. S., vol. vii. pp. 196, 197.

‡ London Medical Repository, vol. iii. p. 388. A case where it proved useful is given in *ibid.*, vol. xii. p. 18.

§ *Lancet*, N. S., vol. x. p. 836.

|| Christison, p. 200.

tation are needed. Stimulants may subsequently be necessary.

BINOXALATE OF POTASH. I notice this and another article, in this place, because each owes its poisonous properties to the presence of oxalic acid. The present substance has several common names, as the salt of sorrel, essential salt of lemons; and it forms a constituent in some of the lozenges that are sold under the name of parliament, or lemon-drops.

There have been several cases of poisoning with it, and some fatal. The symptoms and mode of treatment are similar to those above stated. The tests are also much the same, because the acid is in excess. The presence of potash can also be ascertained.*

RHUBARB OR PIE PLANT. (*Rheum rhaponticum*.) Of late years this species of rhubarb has been much cultivated in our gardens, and, from its pleasant acid taste, employed as greens, or for making pies. Occasionally we have notices of its proving hurtful. Thus, in the Buffalo Medical Journal, (vol. i. p. 19,) it is mentioned that a family of four persons in that city, after eating very freely of the leaves, boiled and served as greens, were all of them, shortly after, seized with severe vomiting. In one this was followed by gastritis, but the remainder escaped without any subsequent bad symptoms. The Northern Lancet, published at Plattsburg, in this State, relates (May, 1850,) of a family poisoned from exactly the same cause. They were all extremely ill, and the maid died the next day.

It is probable that the stalk is not so deleterious as the leaves. But the injury would seem to result from the presence of an oxalate. The root of the medicinal rhubarb does not seem, according to Dr. Christison, to contain any free oxalic acid, but oxalate of lime, varying, according to the different localities producing it, from 11 to 35 or 40 per cent. Lieut. Long, of the U. S. army, M.D. by previous education, made an analysis subsequent to the accident at Buffalo, and ascertained that the small bundles in market, weighing about one pound,

* For cases, see London Medical Gazette, vol. xxvii. p. 480; Annales d'Hygiène, vol. xxvii. p. 422; Edinburgh Med. and Surgical Journal, vol. lviii. p. 506.

contain 24 grains of oxalic acid. Although it was in combination with lime, yet certainly the total is a dangerous compound.* We much need a careful examination of the matter, since the ordinary use of the plant in pies has not proved so hurtful as to excite general attention.

TARTARIC AND CITRIC ACIDS. Orfila and Devergie arrange these among the poisonous acids, but without stating any cases. Christison and Coindet gave each to cats, in doses of a drachm dissolved in twelve parts of water, without any effect.† We have, however, now a case in which tartaric acid was sold, by a druggist in London, for Epsom salts. The purchaser, a cab-driver, took an ounce dissolved in half a pint of warm water. He instantly felt a dreadful burning sensation in his throat and stomach. Preparations of soda and magnesia were soon given, with diluent drinks. But vomiting commenced and continued during life, which was prolonged nine days. On dissection, inflammation through nearly the whole extent of the alimentary canal was found.‡

PHOSPHORUS, when dissolved in oil and injected into the jugular vein, instantly produced copious exhalations of phosphorous acid. The respiration was difficult and panting, a considerable quantity of a bloody serosity was thrown up, and death followed in twenty minutes after the injection. The lungs, on dissection, exhibited several livid and dense portions; the stomach was natural, and the left ventricle of the heart contained blood as black and fluid as that which filled the right.

When phosphorus is introduced in small lumps into the stomach, it does not at first induce any remarkable effect, but the animal falls gradually into a state of depression, and dies. The stomach is much inflamed, and contains a thick, greenish fluid. In an experiment where our author administered one hundred and forty grains in small lumps to a dog, one hundred and twenty-seven only were found after death in various parts of the intestines. The action of this substance is infinitely

* Buffalo Med. Journal, vol. i. p. 37.

† Edinburgh Med. and Surgical Journal, vol. xix. p. 185.

‡ Lancet, January 2, 1845; Pharmaceutical Journal, vol. iv. p. 372.

more violent when it is introduced into the stomach in a state of solution with oil. Fumes of phosphorous acid were exhaled from the lungs, and the subject seemed to suffer exquisite torture. It then lay immovable, but about six minutes before he expired general and violent convulsions occurred. The stomach was corroded in three places, and the mucous membrane, where it had not been perforated, was reduced to a stringy kind of pulp. The lungs were red, distended with blood, and did not crepitate.*

Cases of its fatal effects on man are also not wanting. The following is related by Dr. Worbe:—

On the 24th of April, 1824, a young man took half a grain mixed with hot water. Finding no bad effects, he took a grain and a half in the same vehicle at a single dose. He breakfasted almost immediately, and experienced no bad symptom until about five o'clock, when he had no sooner swallowed some food than he complained of violent pains in the stomach and abdomen. Incessant vomiting followed, with diarrhoea. Remedies were resorted to with little effect. An extreme tenderness at the abdomen remained, and he gradually sunk until the twelfth day, when he died.†

M. Dieffenbach, chemist, at Biel, took first one grain of phosphorus, and finally increased it to three grains. The result of this last experiment was violent pain, which in a few days was followed by vomiting a greenish matter of a garlic-like smell. The irritation of the stomach could not be allayed. Convulsions and a paralysis of the left arm succeeded, and he died on the twelfth day.‡ [Phosphorus-paste is extensively used for

* Orfila, Toxicology, vol. i. p. 405. Similar results were obtained by Harlan. See his Researches, p. 445. Dr. T. Thomson states that if phosphorus be allowed to stand in water for some time, it will render that fluid poisonous to animals who drink it. (Annals of Philosophy, vol. xvi. p. 232.)

† Edinburgh Medical and Surgical Journal, vol. xxviii. p. 228.

‡ Lancet, N. S., vol. iv. p. 357. Other fatal cases are given by Lobstein, in his work on Phosphorus, New York Medical and Physical Journal, vol. iv. p. 413, and by Weickhard, quoted in Hooper's Medical Dictionary. I am aware that the experiments of Chabert have induced some to suppose that phosphorus is innocuous. I doubt, however, whether they would be willing to swallow and retain the quantities he took.

"I once administered," says Mr. Pereira, "sixteen grains of phosphorus to

the extermination of vermin, and has already been the cause of fatal accidents. According to one formula, it consists of one drachm of phosphorus, five ounces of flour, and an ounce and a half of sugar, made into a paste by means of water. The phosphorus may be separated, for analysis, by the solvent sulphide of carbon, or converted into phosphoric acid by boiling with diluted nitric acid.]

The *appearances on dissection*, in M. Worbe's case, were a yellow skin, with occasional livid spots; the lungs gorged with blood; the muscular coat of the stomach inflamed, but the internal ones not, except at the two orifices, where there were slate-colored patches. All the intestines were tympanitic. In another case, by Dr. Flachsland, the external coat of the stomach was red, and the villous presented marks of inflammation. So also did the same coat of the duodenum; the kidneys and spleen were inflamed.*

Treatment. As inflammation is evidently the consequence of the exhibition of phosphorus, we should of course use the appropriate remedies for removing it. An emetic must be premised, to remove, if possible, the poisonous ingredient; and water, containing magnesia in a state of suspension, is also advised, as tending to fill the stomach with fluid, and at the same time neutralizing the acid that is forming.

Phosphorous acid, according to Dr. Hunefeld, produced, in the dose of a drachm, difficult breathing, bloody vomiting, convulsions and death in twelve hours, in a rabbit. The villous coat of the stomach was brownish red near the cardia alone. There was no smell of phosphorus, but the urine contained phosphoric acid. It would indeed seem, from the experiments of Weigel and Krug, that phosphorus is far more poisonous than phosphoric acid.†

Chabert, without any hurtful effect. He washed them down with a tumblerful of water. He offered to take this dose daily. How he counteracted the effects, I know not; but I suspect he excited vomiting, for within ten minutes after swallowing the phosphorus, he left the room for about a quarter of an hour." (London Med. Gazette, vol. xvii. 886.)

* Christison, p. 169.

† Edinburgh Med. and Surgical Journal, vol. xxxvi. p. 461; Encyclo-graphie des Sciences Médicales, February, 1845.

Dr. Glover gave fifty grains of *glacial* phosphoric acid, dissolved in two

The effects of phosphorus have of late years attracted increased attention, from the fact of its extensive employment in the manufacture of lucifer matches, or what we in this country frequently style *loco-foco* matches. The better article consists of a combination of phosphorus and chlorate of potash; while others consist possibly of less of the latter, with an addition of sulphur. Phosphorus is, however, the leading ingredient.

The following points have been made the subject of inquiry. The diseases, if any, to which workmen employed in the manufacture are liable. It was at one time considered scarcely possible that the vapor could be inhaled without permanent injury, but the researches of Dupasquier at various factories throw a doubt on this.* Again, from the testimony of a number of observers, whether the cause was the vapor or something else, it would certainly appear that caries of the teeth, and even of the jaws, with irritation of the bronchiæ, was far too common with the workmen to prevent a suspicion that the cause was in the employment. I have collected in another place the observations on this subject, and mentioned there the alternative opinion that the affections may be owing to vapors of arsenic, which last has, in some process of manufacture, become united with the phosphorus used.†

There can, however, be no doubt of the poisonous effects of lucifer matches themselves, when taken internally. Cases are multiplying in the medical journals and in newspapers, of children destroyed by them. They sometimes suck the ends before they are observed, and the result is very frequently fatal, being preceded by vomiting and convulsions. On dissection, the inflammation of the alimentary canal is very marked and extensive, accompanied with ulceration and even bloody effusions.‡

drachms of water, to a rabbit, without any effect. (Edinburgh Med. and Surgical Journal, vol. lviii. p. 121.)

* Comptes Rendus, August 31 and September 28, 1846.

† American Journal of Med. Sciences, N. S., vol. xii. p. 525. Also, Annales d'Hygiène, 1856, vol. ii. p. 5; and 1857, vol. i. p. 431.

‡ I may cite cases in the London and Edinburgh Monthly Med. Journal vol. iii. p. 362; Lancet, December 30, 1843.

Red or amorphous Phosphorus—an allotropic form of the element—is entirely innocuous, as experiments with it in large doses evince. (See *Annuaire de Thérapeutique*, 1855, p. 103.) It is distinguished and separated from common phosphorus by its insolubility in sulphide of carbon. It is not luminous in the dark, and is not soluble in any liquid.

IODINE. Orfila was the first who performed any experiments with this substance. He found that dogs, if they vomited freely, survived, although they had taken a drachm and upwards of it; but when this did not occur, or if the œsophagus was tied, it invariably proved fatal after exciting violent efforts to vomit, hiccough, thirst, quick pulse, and great depression. The mucous membrane of the stomach was always found corroded and ulcerated, but the lungs and other organs were natural.

Our author was able, in some cases, to detect the iodine in the matter vomited and passed by stool. On drying and exposing it to heat, the violet-colored vapor appeared.

A drachm and twelve grains were sprinkled on a wound on the back of a dog. The skin immediately grew yellow, and in three days an eschar formed, leaving the subjacent parts highly inflamed. The animal, however, recovered.

Our author next ascertained the effects of iodine on the human subject. He himself took two grains fasting; but they only excited an abominable taste, and nausea. The next morning he took four grains. He was immediately sensible of constriction and heat in the throat, which continued a quarter of an hour, and he soon vomited yellow liquid matter, in which iodine was readily discovered. Two days after he took six grains, which instantly excited heat and constriction of the throat, nausea, irritation, salivation, and pain of the stomach, and, in ten minutes, copious bilious vomitings and slight colic pains, which yielded to two emollient enemata, after having continued an hour. The pulse rose from 70 to 90, and was fuller. The next day he felt only a slight fatigue.*

* Orfila's *Toxicology*, vol. i. p. 490. There is probably a mistake in the statement that has been made of Magendie taking a scruple of iodine in the form of tincture, without inconvenience. According to the eighth edition

Shortly after, or about this time, iodine came extensively into use for the treatment of bronchocele. It was undoubtedly given in too large doses; and the effects, as stated by Coindet, were rapid emaciation, severe pain in the orbits and eyes, with great defect of vision; neuralgic pains in various parts of the body, palpitation of the heart, and not unfrequently inflammation of some of the organs. In females, a rapid diminution of the size of the breasts (and this continuing permanent) was early noticed.*

Fatal cases are not wanting. In these, severe vomiting and purging were a common occurrence. Dr. Zink, a Swiss physician, relates two instances of death from its incautious use. In one, there was diarrhœa, priapism, tremors of the whole body, and palpitation. The body was not opened. In the other, it was, and a violent inflammation of the stomach and intestines was found.†

In an instance where two drachms and a half of iodine were taken for the purpose of suicide, a sense of burning, from the throat to the stomach, was soon perceived, and nausea and acute pain followed. In an hour, vomiting of a yellowish fluid, having the taste of iodine, ensued. This was promoted by the use of warm water, while the attendant symptoms were counteracted by enemata and gum-water. The patient recovered.‡

As to the *tincture* of iodine, there exists some diversity of

of his Formulary, the quantity cannot have been more than six grains. (London Med. Gazette, vol. xxii. p. 505.) Devergie thinks that from 18 to 30 grains will prove fatal to man. Vol. ii. p. 531.

* Medico-Chirurgical Review, vol. iv. p. 757. Review of Brera and Coindet, on Iodine. See also, the Review of Gairdner's Work, in *ibid.*, vol. v. p. 104.

† Anderson's Journal, vol. ii. p. 148; Edinburgh Med. and Surgical Journal, vol. xxiii. p. 225.

‡ Case by Dessaigne. Littel's Journal of Foreign Medicine, vol. i. p. 569, from Journal de Chimie Médicale. I must not leave the notice of the effects of iodine without mentioning that Dr. Rivers, of Tennessee, has stated two cases in which it appears to have produced barrenness. A lady, who married at seventeen, suffered under goitre, but for the three first years had a child annually. Iodine was now exhibited for the disease, which it partially diminished, and it also affected the breasts. Eight years have elapsed, and she has not been pregnant again. Other similar cases are said to have occurred. (American Journal of Med. Sciences, vol. viii. p. 546.)

result. According to Magendie, the injection of it into the veins of a dog produced no dangerous effects, while Dr. Cogswell found that two drachms speedily destroyed life. Fontanelle mentions the case of an individual in France who swallowed by mistake four ounces of tincture of iodine (equal to 147 Troy grains), without any effects, except slight heat at the stomach.* Dr. Buchanan has given large doses of the iodide of starch and hydriodic acid without any injurious consequences.†

Tests. When in a solid state, iodine may be detected by its peculiar odor; the violet fumes it forms when heated, and the fine *blue* color it produces with a solution of starch.

When dissolved in water or solutions of neutral salts, it communicates a yellowish or reddish-brown color to the fluid. This is destroyed by sulphuretted hydrogen. "In the colorless fluid thus formed, if treated with a drop or two of sulphuric acid, or in the original brown fluid without sulphuric acid, a cold solution of starch produces a fine blue color and precipitate, which, if the solution be sufficiently diluted, disappear on boiling, reappear on sudden cooling, and are removed permanently by a stream of sulphuretted hydrogen."‡ This, says Dr. Christison, is a very delicate and characteristic system of tests.

If mixed with organic substances, the difficulty of detection is increased, from the fact that it often undergoes important

* Edinburgh Med. and Surgical Journal, vol. xlvii. p. 521; British Annals of Medicine, vol. i. p. 222.

† London Med. Gazette, vol. xviii. p. 515. The application of tincture of iodine to an excoriated surface has caused some of the severest symptoms of poisoning. (Lancet, N. S., vol. xxxi. p. 791.)

‡ Christison, p. 170. Stromeyer advises that *nitric* acid be added to the suspected liquid. I may also mention the process of Baup. Having added nitric acid to the liquid, he suspends above its surface a moistened paper sprinkled with starch. The vessel containing these is then closed, and allowed to stand at rest for some hours. If iodine be present, the starch will become blue. This is said to be a very minute test, and Berzelius recommends it, inasmuch as the matters precipitated in the solution by the acid cannot act on the starch, or produce a color that might be mistaken for it. (Berzelius' *Chimie*, vol. i. p. 305.)

Chloride of palladium is named by Baumann as a minute test of iodine, depositing black flakes. (London and Edinburgh Med. Journ., vol. iii. p. 364.)

changes in the alimentary canal. It is converted, in some instances, into hydriodic acid; and in others the mixture may be so dark as to prevent the characteristic action of the starch.* Dr. Christison recommends the following process for such a mixture: Add water, if necessary, and filter. If it be but little or not at all colored, test it with the cold solution of starch. If the blue color appear, disappear on boiling, and return again on cooling, there is no doubt of the existence of iodine. But if the filtered mixture is too deep colored to permit the action of the starch, then agitate both solid and fluid parts with a third of their volume of ether, and after the ethereal solution has risen to the surface, remove it and test it with the solution of starch.†

Iodine has been detected by Cantu in the sweat, urine, saliva, and milk of persons who have taken it; and Benner-scheidt, a German chemist, has found it in the blood drawn from the veins. He detected it in the crassamentum, but not in the serum.‡

Dr. O'Shaughnessy detected it in the urine of a dog poisoned, in forty minutes, and occasionally after that as late as the fifth day, when the animal died. He found it also in the saliva. In these experiments, it was always in the form of hydriodic acid, having been changed to this in the alimentary canal.§

Treatment. If this substance has been taken in large quantities, the first indication, of course, is to obviate its consequences, by means of emetics or the stomach-pump. Dr. Thomson also advises that cold mucilage of starch, or boiled flour and water, be drank freely. The subsequent effects, which are commonly those of inflammation, must be combated by the appropriate means. In smaller doses, but where unfortunately this substance appears to accumulate in the system,

* Dr. O'Shaughnessy, in *Lancet*, N. S., vol. vi. p. 633. Another difficulty mentioned by him is the ready formation in the alimentary canal of a compound consisting of iodine and albumen, totally insoluble in alcohol, and nearly so in water.

† Christison, p. 171.

‡ *North American Med. and Surgical Journal*, vol. vii. p. 432.

§ *Lancet*, N. S., vol. vii. p. 613.

before it manifests its powerful results, a long and patient course of antiphlogistic and soothing treatment is often necessary.*

HYDRIODATE OF POTASH. (*Iodide of potassium.*) This substance, in large doses, according to the experiments of Devergie, acts as an irritant on animals. Two drachms, in an ounce of water, killed a dog in three days with violent vomiting, and black extravasated spots and ulcers were found in the stomach. Injected into the jugular vein, in the dose of four grains, it produced tetanus and death in a minute and a half. Dr. Cogswell obtained similar results. He destroyed animals by introducing it under the skin.

On man, this substance in large doses acts like iodine. It affects the nervous system powerfully, and has caused ptyalism and diuresis. Of poisoning in the human subject several cases are related. A drachm and a half of the solution of hydriodate of potash were taken for the purpose of committing suicide. The symptoms were immediate distress, nausea and burning, and acute pain at the stomach. In an hour vomiting ensued, with great suffering and vertigo. By the use, however, of warm water, enemata, and mucilages, the patient recovered.†

Dr. Lawrie, of Glasgow, mentions several instances in which the daily exhibition of one or two grains of the hydriodate soon produced a dryness and irritation of the throat, followed by all the symptoms of severe croup; and in two cases, although the patients were laboring either under cancerous or syphilitic affections, he is of opinion that the use of the remedy—in one for six days, and in the other sixteen days—was the immediate cause of sudden death, which was produced alike by inflammation and œdema of the larynx.‡

Tests. The importance of understanding these is greatly increased from the fact already mentioned, of the probability

* A free use of carbonate of soda is also advised by Mr. Taylor.

† Medical Recorder, vol. xiv. p. 371, from Archives Générales for February, 1828.

‡ London Med. Gazette, October 26, p. 588. See also, *ibid.*, vol. xxviii. p. 911; Lancet, October 16, 1841, p. 96; Dr. Coates, in Med. Examiner, N. S., vol. i. p. 65.

of the conversion of iodine into hydriodic acid in the stomach. A little of the fluid, therefore, after filtration, should be mixed with the solution of starch as above directed, and a *few drops of sulphuric acid* be then added. The blue tint will appear, if there be an appreciable quantity of hydriodic acid present. Acetate of lead throws down a fine yellow precipitate, the iodide of lead; muriate of platina a dark brown one, the iodide of platina; and corrosive sublimate a fine carmine red, the periodide of mercury.*

But in compound mixtures hardly any of these will answer; and particularly not if, as is so common at present, the hydriodate be adulterated. The only one among them that Dr. O'Shaughnessy deems deserving of confidence, is the muriate of platina; and he therefore recommends it in all cases, along with the use of the starch test. The process which he advises is as follows: Make first a trial experiment, to ascertain whether any *free* iodine be present. If no blue color is produced, boil the mixture and filter. Neutralize, if necessary, with caustic potash, and reacidulate with acetic acid. A few drops of muriate of platina may now be added; and if hydriodic acid be present, there will be either a dark-red precipitate, or the fluid will be changed of a port-wine color. Agitate it now with an ounce of ether, which dissolves the iodide of platina, and separates it from the other fluids swimming on their surface. Remove this by a suction-tube, evaporate to dryness, heat the iodide of platina by a spirit-lamp in a small glass tube, and the iodine will exhibit its characteristic violet vapors.†

Dr. Christison has, however, found difficulty in producing the characteristic action of the muriate of platina. The process advised by him is this: If the starch test will not act, transmit through the whole of the contents sulphuretted hydrogen, to convert any free iodine into hydriodic acid. "Drive off the excess of gas, supersaturate with a considerable excess of potash, filter and evaporate to dryness. Char the residue at a low

* Christison, p. 176. Mr. Kemp says that the proto-nitrate of mercury in solution is a most minute test of the hydriodate. A yellow precipitate falls down, the protoiduret of mercury. He thus detected iodine in the urine. (London Med. Gazette, vol. xviii. p. 450.)

† Lancet, N. S., vol. vi. p. 637, vol. vii. p. 612.

red heat in a covered crucible, pulverize the charcoally mass, and exhaust with water." This solution will probably act with starch and sulphuric acid: but if it does not, evaporate to dryness and dissolve the residuum in alcohol. This solution contains hydriodate of potash; and on being evaporated to dryness, a residuum is left, on which, when dissolved in water, the starch and sulphuric acid will act.*

I find a test recommended on the authority of Balard, which may probably render these processes unnecessary. It is to mix the suspected fluid with starch, sulphuric acid, and fluid chlorine. If necessary, agitate this compound. In a short time, if left at rest, the starch acquires a distinct violet color. One part of hydriodate of potash was dissolved in two of distilled water; this was largely diluted, and the other substances then added in very small quantities. In fourteen hours the starch became slightly colored, and in twenty-four hours it had a marked violet hue.† Dr. Anthony T. Thomson has recently advised the use of chlorine *gas* instead of *fluid* chlorine, and without any sulphuric acid. His method is to mix a small quantity of the solution of starch with the fluid to be tested, and then pour on the surface of the liquid some chlorine gas. A blue film at once appears and gradually pervades the whole, if any hydriodate be present. This also proves a very minute test.‡

A curious fact is mentioned by Orfila, which deserves a place here: Some time since, a quantity of salt containing ioduret of potassium was seized by order of the authorities of Paris. It readily gave the blue color with starch, sulphuric acid, and

* Christison, p. 177. It must not be forgotten that, in suspected cases, we are to look for iodine or its salts in the urine, blood, or saliva, as well as in the contents of the stomach.

† Brande's Journal, N. S., vol. vii. p. 200; Reid's Chemistry, second edition, p. 205. Dr. Reid says that this is the best method of detecting minute portions of iodine in solution.

‡ London and Edinburgh Philosophical Magazine, vol. iv. p. 438. Dr. Thomson subsequently recommended nitrous acid gas as equally efficient with gaseous chlorine. It is to be used in the same manner. London Med. and Surgical Journal, vol. ix. p. 446. I find, however, that at a subsequent period he remarked that gaseous chlorine is the best, since it detects the salt in every proportion. (Lancet, N. S., vol. xx. p. 708.)

chlorine; but was insensible to the operation of the salts of platina and mercury. What was, however, astonishing, was, if a drop of the ioduret was added to a solution of pure chloride of sodium, the salts caused their characteristic effects. It is difficult, says Orfila, to explain this diversity, unless we admit that, in the case of the salt when crystallized, the ioduret is combined with the chloride of sodium; while in the other, the two salts are simply mixed.*

BROMINE. This substance, according to the experiments of Barthez, Butske, and Dieffenbach, is an active poison. When ten or twelve grains were dissolved in water, and injected into the jugular vein of a dog, they caused immediate death, preceded by a single tetanic convulsion; and on dissection, the heart was seen gorged with clotted blood. In small doses, it produced restlessness, difficult breathing, dilated pupil, and sneezing. When introduced into the stomach to the amount of from 40 to 60 drops, the symptoms were similar to the last, accompanied with violent vomiting. After some hours this would abate; and then, without any striking symptoms except languor, death ensued in four or five days. The villous coat of the stomach was found ulcerated. Dr. Butske, in his experiments, found it to act more rapidly, and death was induced in a day.

The *hydrobromate of potash*, in doses of half a drachm, did not appear to act as a poison; but two drachms, retained in the stomach by tying the gullet, occasioned death in three days, with symptoms of irritant poisoning.

From the observations of Barthez, it appears probable that bromine is converted very shortly into hydrobromic acid, in the stomach, resembling iodine in this respect.

At a later period, Dr. Glover carefully examined the effects of bromine. They were first announced to the British Association in 1840; and in 1842 formed the subject of the Harveian Prize Essay at Edinburgh. This is published in full in volume lviii. of the Edinburgh Medical and Surgical Journal.

When bromine was introduced into the stomachs of animals, the appearances found were those of the most violent irrita-

* Orfila's Leçons, third edition, vol. iii. p. 27.

tion, and even corrosion, and this not only in the digestive organs, but extending to the air-passages and the lungs. The volatilized bromine probably induces the latter. Dr. Glover remarks that bromine is more irritant when diluted than when pure. *It is an irritant independent of its corrosive action*; and he found this substance, in some instances, in the urine of animals poisoned by it, and in the blood in others.

Hydrobromic acid was found to be less powerfully corrosive and irritant than bromine; still its effects in large doses were well marked.

He found the bromides generally to have but little corrosive action. Bromide of potassium is, however, poisonous; while bromide of sodium resembles common salt in its physiological properties, and is not more energetic. Bromide of barium and of magnesium, in considerable doses, also caused death, with reddening and corrosion of the mucous membrane of the stomach. Bromide of zinc is probably more active than either of the two last.

I am not aware of a single case on record, of poisoning of the human subject by bromine, except the one published (Sept. 1850) in Dr. Purple's New York Journal of Medicine, by Dr. Snell, of Long Island:—

A male took nearly an ounce of bromine with a suicidal intent. In half an hour, when first seen, the lips, tongue, mouth, etc. were highly inflamed; there was burning pain, and tremors of the hands and arms. In a few hours, marks of increased suffering and prostration ensued; the saliva flowed very freely, the mucous rattle increased, and deglutition was impracticable, but there was no retching or vomiting. Death followed, with the usual symptoms of suffering, at the end of seven and a half hours. The stomach was found covered on its internal surface with a thick, black layer, resembling tanned leather, and peeling off very readily; the mucous membrane softened and injected, and the lower part of the stomach hard and tanned. Similar appearances were seen in the duodenum. The peritoneum and omentum were deeply tinged with bromine, and much injected.

The tests of bromine, when pure, are its color, its orange fumes, and its suffocating vapor. When mixed, Barthéz ad-

vises that it be subjected to the action of chlorine, which will produce a fine orange color; or if this does not answer, treat the solid matter with caustic potash, filter, and add what passes through to the former fluid, evaporate to dryness and char, and then act on the residue with distilled water. The solution contains hydrobromate of potash, and is therefore turned orange red by chlorine.* Hydrochlorate of platina gives, with hydrobromate of potash, a canary-yellow precipitate.† Chloride of gold is recommended by Dr. Glover; its solution gives a red tinge.

Antidotes. Although Dr. Glover recommends a solution of starch, or the whites of eggs, yet there can be but little doubt that the latter is far preferable. From statements made by Mr. Smee,‡ and also by Dr. Snell, it is quite certain that ammonia acts very favorably. Its vapor is said to be constantly employed by persons engaged in taking daguerreotypes, to ward off the injurious effects of occasional inhalation.

Barthez proposed magnesia, but the bromide of magnesium is far from being inert.

We have reason to fear, from its extensive employment in the arts, that many succeeding cases of poisoning may occur.

II. *The Alkalies, Alkaline Salts, and Lime.*

PURE POTASH, when externally applied, is well known to act as a powerful caustic. On injecting a solution of it into the jugular, it produces sudden death; and on dissection, the blood is found coagulated. When swallowed by an animal, it corrodes the stomach, and inflames its mucous membrane.

Dr. Massart relates of a man who swallowed some liquor potassæ by mistake. Severe pain followed, with nausea and a general coldness. Tartaric acid in solution was given at intervals with great relief, and this, with sinapisms and enemas, appears to have saved the patient's life. Two days after, a

* Christison, p. 180; North American Med. and Surg. Journ., vol. viii. p. 432.

† Devergie, vol. ii. p. 539.

‡ London Medical Gazette, vol. xxxii. p. 61.

very tough and thick membrane was thrown off from the tongue and back part of the mouth. He, however, gradually recovered.*

Dr. Bretonneau has stated the following curious results obtained by him on dogs: Aware of the caustic operation of potash on the mouth and œsophagus, he introduced, by means of a tube, from 40 to 60 grains of the pure alkali into the stomach. Bloody or mucous vomitings ensued, and sometimes, indeed, pure blood was thrown up. But after two days, during which the animals displayed no appetite, they gradually returned to their accustomed habits, as if no disease existed. Several were killed weeks afterwards, which had been remarked for their voracity and high spirits; and yet, on dissection of all these, the mucous membrane of the stomach was found nearly altogether destroyed. In some instances the muscular and peritoneal coats were consolidated, showing thick and rough cicatrices even on the external coat of the stomach.†

The *subcarbonate of potash* (salt of tartar) is also a poison of considerable activity. A dog, to which two drachms were administered, died in fifteen minutes; and Plenck mentions a case where a patient in good health took an ounce, which produced violent vomiting and gastritis. Life was, however, preserved.‡ There are, however, fatal instances on record.

A small boy took by mistake about three ounces of a strong solution. When Mr. Dewar saw him, an hour afterwards, the tongue, gums, and fauces appeared as if seared with a hot iron, while the inside of the cheeks was highly inflamed. Vomiting occurred incessantly, and remedies had no effect. He died in twelve hours. On dissection, the mucous membrane of the pharynx and œsophagus was seen totally disorganized, and blood was universally extravasated between the muscular and pulpy mucous coats.§ The stomach was generally inflamed,

* British and Foreign Med. Review, vol. iv. p. 239, from Gazette Médicale de Paris.

† Orfila's Leçons, third edition, vol. iii. p. 66.

‡ Orfila's Toxicology, vol. i. p. 380.

§ Other cases of chronic poisoning by potash, in Med. Times and Gazette, November, 1853, p. 554; May, 1857, p. 537.

and its mucous coat destroyed in two places. Clotted blood covered these injured parts.*

The following cases will illustrate its more chronic effects:—

Two females, of the age of sixteen and twelve, each took by mistake half an ounce of subcarbonate of potash. Violent sickness immediately ensued, but the error was not discovered until two hours and a half afterwards. The vomiting and sickness scarcely ever ceased entirely with the elder, and she also experienced pain in the epigastric region. Leeches were applied, and various curative means, but with little success. The vomiting, though occasionally checked, yet returned with violence, and she died in about two months after taking it. The other suffered under sickness for three days, and it then ceased. She appeared to grow better: but in a few weeks the sickness returned, and she was confined to her bed. Death ensued about three weeks after that of her sister.

The appearances of disease were similar in both, although most striking in the elder. The stomach was much thickened, and the villous coat was almost wholly destroyed; what remained was in a state of high inflammation. The pylorus in one was much ulcerated, and in the other contracted and gangrenous. The intestines were gangrenous, and adhered together by thin threads of coagulable lymph. The omentum in the younger was almost totally destroyed, and the glands of the mesentery for the most part absorbed. The liver in both was of a dark-green hue, in consequence of the transfusion of bile; and the gall-bladder was distended with it, probably from the circumstance that the biliary ducts were found almost obliterated.

Both these females had previously been in delicate health.†

* Dewar, in *Edinburgh Med. and Surgical Journal*, vol. xxx. p. 309. Dr. Cox mentions another instance in a child three years old, who swallowed some deliquescent potash. It apparently suffered no pain, nor was there any retching or vomiting except from the use of medicines. Death ensued in twenty-four hours. Marks of inflammation and erosion were found as in the above case, and the rima glottidis was narrowed by vascular extravasation into the subcutaneous cellular tissue. (*Lancet*, N. S., vol. xvi. p. 660.)

† *London Med. Repository*, vol. vii. p. 118. Mr. Dewar mentions a case where the immediate effects were counteracted; but in four or five days, sloughs began to separate from the lining membrane of the mouth, throat,

The peculiar styptic and urinous taste, a severe heat in the throat, retchings, vomitings of an alkaline matter which commonly effervesces with acids, copious alvine evacuations and pain, are among the leading symptoms produced by this substance.

Orfila suggests that this alkali, of all the corrosive poisons, is that which most frequently perforates the stomach. It also causes inflammation of the different coats of this viscus, and of the intestines.

Antidote. Vinegar and lemon-juice are the most valuable remedies for this purpose, and their use should be aided by mucilaginous drinks.

Dr. Cherau has published two cases of poisoning with carbonate of potash, in which large quantities of sweet oil proved signally useful. It excited vomiting, and he imagines that it unites chemically with the potash in the stomach. Several pounds are, however required.*

Orfila has shown that potash is absorbed by the blood, and renders the urine alkaline. In consequence of its solvent power over fibrin and albumen, the blood is not coagulated in the vessels after death.

Chemical tests. Carbonate of potassa yields, with solution of nitrate of silver, a whitish yellow precipitate, while caustic potassa gives, with same solution, a brown precipitate. Bichloride of platinum precipitates canary-yellow with caustic potassa, while an excess of tartaric acid gives granular white crystals. Potassa imparts to a white or colorless flame a rose or lilac color, while soda gives to the same flame a rich yellow color.

Nitrate of potash. (Nitre, salt-petre.) This salt, in large doses, acts as a corrosive poison, and cases illustrative of this effect are mentioned by various writers. An individual labor-

and gullet. This ended in stricture, and after many alterations of apparent recovery and illness, caused death from starvation in four months. (Edinburgh Medical and Surgical Journal, vol. xxx. p. 310.) Dr. Christison quotes a parallel case from Sir Charles Bell, where the swallowing of soap-lees was the cause. An instance of severe symptoms, but of final recovery, from taking an ounce of salt of tartar in solution, is related by Dr. Liegard. It was cured by vinegar. (Bulletin de l'Acad. Royale de Médecine, vol. i. p. 151.)

* London Med. Repository, vol. xx. p. 440.

ing under a fever, took by mistake an ounce and a half of nitrate of potash. In a short time, severe anguish, with a sense of internal cold, supervened, and fainting and syncope followed. He died in less than ten hours.*

A female took an ounce and a half by mistake. It excited vomiting and purging, with violent pain in the bowels. The extremities were cold, while a burning sensation was experienced in the stomach; the pulse was almost imperceptible, and she died in sixty hours after taking the salt. On dissection, the stomach was found red, and chequered over with blackish spots, and in the centre of one of these was a small hole which perforated it. The intestinal canal was reddish.†

In a third case, related by M. Lafize, an ounce produced similar effects, and death in three hours. The stomach was very highly inflamed, and its mucous coat detached in several places; the external coat was of a deep red, and some brown spots were observed on it.‡

There are, however, some instances where patients have recovered after taking large doses. A pregnant female by mistake took two ounces, which immediately excited vomiting, first of the contents of the stomach, and then of blood. As soon as the alarm was given, warm water and mucilaginous drinks, (gum arabic, linseed tea, etc.) were exhibited. Burning pains at the stomach, however, supervened; the pulse sunk, and a cold, clammy sweat broke out. The vomiting recurred frequently with violence. From this she was gradually relieved, but the pains in the abdomen continued for a longer time; and when convalescent, and ten days after the taking

* Quoted from Comparetti. Orfila's Toxicology, vol. ii. p. 87.

† Case by Sovuille. Orfila's Toxicology, vol. ii. p. 87.

‡ See Foderé, vol. iv. p. 82. Metzger, p. 385, and Belloc, p. 141, refer to several cases where nitre has proved poisonous. Another fatal instance occurred in the vicinity of this city, in the person of a gentleman aged seventy-five. He mistook it for Glauber's salts. Death followed in half an hour.

A fatal case, in a person aged sixty years, at Manchester, who must have taken about ten drachms in solution, and which caused death in a few hours, after diarrhoea, and where there was found inflammation of the stomach and bowels, is quoted from the Dublin Journal, in Medical Examiner, vol. viii. p. 67.

of the salt, she was seized with a nervous affection, greatly resembling chorea. Twitching of the muscles, and involuntary motions, were present to an alarming degree, and they continued for two months. They gradually left her, and she was at last happily delivered.*

Effect on animals. Five drachms and a half given to a dog caused vomiting, but on the day following he ate well, and experienced no remarkable symptoms. But when the cesophagus was tied, and the salt introduced into the stomach, it excited vertigo, pain, slight convulsions, insensibility, weakness, and death. The mucous membrane of the stomach was inflamed, and scattered over with black spots. The lungs were natural.

When nitre in powder was applied to a wound on the back of a dog it produced no effect. But an application of it to an incision near the femoro-tibial articulation produced gangrene, after some days, and the animal died.

For its chemical detection the same process must be followed as was recommended for nitric acid, omitting, however, the neutralization with potash.

The most proper treatment may be inferred from the narratives given above. Vomiting should be induced, and the

* Case by Mr. Butter, in *Edinburgh Medical and Surgical Journal*, vol. xiv. p. 34. This gentleman observes that he is not aware of any case on record where a patient has taken and recovered from so large a dose of nitre. There is, however, another in the *Memoirs of the Medical Society of London*, related by Dr. Falconer, vol. iii. p. 527. The individual (a blacksmith) took two ounces, and his symptoms were similar to those already detailed, except that he vomited blood to the amount of a quart. He was ill for many months afterwards, and was not dismissed cured from the hospital until nearly a year after the accident. Other cases of recovery are cited by Orfila. See also, Gordon Smith, second edition, p. 151; *London Medical Repository*, vol. xxii. p. 213. Other cases evincing the serious but uncertain effects of nitre, may be found in *Berlin Med. Zeitung*, 1855, No. 49; *Med. Times and Gazette*, November 1857, p. 484.

Dr. Henry Bennet, (*Lancet*, February 10, 1844,) asserts that large doses of nitre, in solution, have been taken with impunity. Such, also, is the tendency of the experiments of Mojon and Rognetta, reported to the Academy of Sciences in 1843. It is not probable that the occasional escape of individuals may be owing to the presence of disease, and that the saltpetre has some such effect as tartar emetic in pneumonia?

stomach-pump has been successfully used in some instances, doubtless as well from its dilution of the nitre as its discharge. The consequent effects often call for the antiphlogistic treatment.

Supertartrate of potash (cream of tartar) would also seem to be poisonous in large doses, at least if we are to depend on a single case. A man, aged thirty-seven, is supposed to have taken a quarter of a pound at one time. Pains, vomiting, and purging ensued, and he sunk, in spite of remedies, in two days. He was, however, an intemperate person. On dissection, marks of high inflammation were found in the stomach and intestines.*

Sulphate of potash (vitriolated tartar.) Is this a poison? It certainly was not so considered until a few years since, when the occurrence of two cases, one in England and the other in France, raised the question. In the latter instance, a female, seven days after a very favorable puerperal period, took, on the prescription of a physician, ten drachms, divided into six doses, and one every quarter of an hour. It caused burning heat of the mouth and stomach, nausea, cramps, vomiting, and purging, and death followed in two and a half hours after taking the first prescription. There were no very striking marks of inflammation found on dissection, and a chemical examination could detect nothing but the sulphate of potash.†

In 1843, a husband gave his wife, as he confessed, in order to make her miscarry, two ounces mixed with water; and it appeared that for a fortnight previous he had repeatedly administered large doses. It induced violent vomiting, and death followed in a few hours. Inflammation of the stomach was observed, with marks of sanguineous apoplexy.‡

These facts certainly show that in large doses the salt in question is far from being innocuous. It is popular in France as an abortive. It is possible that the difficult solubility of

* London Medical Gazette, vol. xxi. p. 177.

† Annales d'Hygiène, vol. xxix. p. 158.

‡ London Medical Gazette, October, 1843; American Journal Medical Sciences, N. S., vol. vii. p. 88. A precisely similar case was the subject of a trial in England, October, 1856. (See also Med. Gaz., vol. xxxiii. p. 54.)

the salt, when taken as above, may aid in causing the severe effects. But the largeness of the dose is, after all, the most probable solution.*

The action of *soda* is precisely similar to that of potash, as is also the mode of treatment necessary to counteract its effects.

AMMONIA, both in its liquid and gaseous state, is extremely caustic and pungent. When injected into the veins, it produces a stiffness resembling tetanus, and violent convulsions. These are soon followed by death. When introduced into the stomach, fatal effects also ensue, and its mucous membrane is found of a red color throughout a part of its extent, but no ulceration or perforation is present.

The following illustration of its severe effects is worthy of notice:—

On the 10th of June, 1840, at about three-quarters past eleven o'clock in the evening, Dr. Souchard, of Batignolles, was suddenly summoned to visit M. A. Pietri, the pupil of a druggist in that place. This young man, whom many had seen a few hours previous in perfect health, was now in the most imminent danger. One of those enormous stone bottles, known in commerce by the name of *bonbonnes*, and which contains about fifty pounds of the volatile alkali, had been delivered late in the evening at the shop. The druggist was doing duty as one of the national guard, and it was too late to procure other assistance in order to carry it into the cellar. The heat of the room probably caused the ammonia to expand, and thus the bottle broke. Pietri slept in a small apartment opening into the shop, but he had scarcely been in bed before he experienced a violent constriction of the throat, and great difficulty of breathing. Unable to account for this, he arose

* Whether *alum* (supersulphate of alumine and potash), in large doses, is a poison, has been elaborately investigated by Orfila, in *Annales d'Hygiène*, vol. i. p. 235, vol. iii. p. 181. He is decidedly of the opinion that it is not. Devergie, however (seeking every occasion to differ from Orfila, as the other does from him), deduces from his experiments that calcined alum in solution will destroy dogs whose œsophagus is tied, if given to the extent of six drachms and upwards. He hence supposes that the same dose will act with greater energy on man, as his stomach is more sensitive. (Vol. ii. p. 658.)

for the purpose of procuring a drink of water, but as he entered the shop the sense of suffocation increased, and he would probably have expired had not a female servant been aroused by his plaintive cries. She succeeded, though not without risk to herself, in dragging him from the tainted air. It is supposed that he had been exposed to it about three-quarters of an hour.

Dr. Souchard directed his immediate removal into the open air. His countenance was covered with red spots; a large quantity of bloody froth issued from the mouth and nose; and the tongue was of a vivid red, and appeared deprived of its epithelium; in some places it was covered with a white mucus, resembling portions of a false membrane, and the cavity of the mouth had a similar appearance. The patient, who could articulate only with extreme difficulty, complained of a cutting pain in the throat, which soon extended to the chest; the respiration was very feeble, and suffocation seemed impending. He experienced great thirst, but it was almost impossible to swallow anything, as the attempt caused violent coughing and a mucous expectoration. The pulse was feeble, irregular, and frequent; the eyes red, and the face burning to the touch. He was bled largely, and with very great relief, and being removed to a bed, vinegar, diluted with water, was regularly administered. Although he swallowed at first with difficulty, yet its good effects were soon manifest in a diminution of the mucous rattle. Leeches were applied to the throat with success, and subsequently frictions, astringent gargles, enemas, and warm baths completed the cure. In forty-eight hours M. Pietri was out of danger, but for several days thereafter he labored under all the symptoms of acute bronchitis, and he had complete aphonia for nearly a week; of all this, however, he perfectly recovered.*

Cases are mentioned where fluid ammonia caused death in

* *Annales d'Hygiène*, vol. xxv. p. 204. This is not by any means the only case in which dangerous and even fatal cases have followed from exposure to this violent irritant. M. Chevallier, in his comments, refers to no less than ten instances, and he has not included all that are on record.

In the vicinity of the Grotto del Cano there is a cave where ammonia, in vapor, is exhaled. See Dr. James, in *Encyclographie*, D. S. M., December, 1843.

the human subject within the space of a few minutes.* Orfila adds a caution against its too free use with persons who have fainted. If inspired too long,† the vapor inflames the throat and lungs, and destroys the individual. The phial containing it should only be passed from time to time under the nose.‡

Vinegar is here also the proper antidote; although from the rapid action of the alkali, means are generally required in addition to this, to counteract the inflammation that frequently occurs.

Hydrochlorate of ammonia (muriate of ammonia, sal ammoniac,) is poisonous when taken into the stomach or applied in large quantities to wounds. It causes vomiting, convulsions, pain in the bowels, and death. Dr. Smith applied it to the cellular texture of the thigh of dogs; vomiting ensued, with great weakness, which increased until death. The mucous membrane of the stomach presented several gangrenous ulcerations, and was generally inflamed; the whole digestive canal contained a blackish fluid, and the rectum was inflamed. In another instance, the mucous membrane was found in a state of putridity.§ Dr. Arnold, in his experiments with it, found

* Orfila's Toxicology, vol. i. p. 387.

† Orfila's Directions, p. 44. Nysten has related such an instance. A case confirming this statement is mentioned in the Edinburgh Medical and Surgical Journal, vol. xiv. p. 642: "A patient was recovering from a severe attack of fever; during convalescence he was, without any evident cause, seized with convulsions apparently of the epileptic kind, which became more and more frequent, and ultimately were so severe as to cause great apprehension of a fatal result. In order to rouse him from the stupor succeeding one of these fits, an attendant most imprudently held aqua ammoniæ to his nose with such unwearied but destructive benevolence that suffocation had almost resulted. As it was, dyspnœa, with severe pain in the throat, immediately succeeded, and death took place forty-eight hours afterwards. In the actual condition of the patient there was little else than death to be expected; yet there is equally little room to doubt that the fatal event was hastened by this unhappy ministration."

Baron Percy mentions the death of the son of an apothecary, from the breaking of a bottle of ammonia, notwithstanding the immediate application of remedies. (Quoted by Dr. Wood, in American Cyclopædia of Practical Medicine, vol. i. p. 363.)

‡ For cases, see Edinburgh Med. Journal, 1857, p. 236; l'Union Médicale, February 19, 1857; and Taylor on Poisons, p. 301.

§ Orfila's Toxicology, vol. ii. p. 469.

convulsions, deep respiration, and contracted pupils, with tetanic spasms, to precede death.*

"No chemical antidote is known against this substance. In the event of poisoning with it, warm water and mucilaginous and demulcent liquids should be given to promote vomiting," and the usual means for counteracting inflammation. (PÉREIRA.)

QUICK-LIME was introduced into the stomach of a small dog to the extent of a drachm and a half in powder. It caused vomiting, and the discharge of much saliva, with some pain; he, however, recovered on the next day. Three days thereafter, three drachms were administered. Vomiting and dejection ensued, and he died in three days, without having experienced either vertigo, convulsive motions or paralysis. The mouth, fauces, and œsophagus were slightly inflamed, and the mucous membrane of the stomach was inflamed throughout its whole extent; the intestines and lungs are natural.

Quick-lime is thus evidently not a very powerful poison, but it may, notwithstanding, prove destructive to life when swallowed. A child fell with her face on a quantity of slaked lime, and a particle of it got into the windpipe. The result was inflammation of the lungs, sloughing of the trachea, and death.†

A case of poisoning by the *oxymuriate of lime* (bleaching liquor) in an infant is related. A small quantity only was given.‡

Treatment. Vomiting should be excited by warm water or irritating the throat, and the nervous or inflammatory symptoms are then to be counteracted by the means already noticed.

Dr. Christison thinks that the *chlorides of soda, potash, and lime* are all active poisons. The first, however, is the only one yet examined. Segales infers from his experiments that it is an irritant, with some symptoms of its affecting the nervous system. Three ounces of Labarraque's liquid caused death,

* Bulletin des Sciences Médicales, vol. ix. p. 182.

† London Medical and Physical Journal, vol. xlv. p. 512. Dr. Christison refers to another fatal case. See also London Medical Gazette, vol. xxv. p. 64.

‡ Ibid., vol. xlv. p. 517.

when injected into the veins of a dog, by coagulating the blood in the heart. Smaller doses introduced into the stomach did not prove fatal, but when the animal was killed in twenty-four hours, the stomach was seen inflamed.* The antidotes in these cases are albumen, flour and water, and mucilaginous drinks. Vomiting should, if possible, be excited.

Hydrogenated sulphuret of potash, (liver of sulphur.) This substance, which formerly was deemed an antidote of arsenic and corrosive sublimate, has been ascertained to be one of the most powerful of the corrosive poisons. A French countess swallowed by mistake some of it which was intended for the preparation of a bath, and she expired in a few minutes.†

In a case related by Dr. Chantourelle, where four drachms were taken, so rapid and abundant was the disengagement of sulphuretted hydrogen that the patient died from asphyxia.‡

In those where life was saved with difficulty, the symptoms were, burning pain in the throat and stomach; frequent vomiting, at first sulphureous, and then bloody; purging; inflammation of the stomach. The dose, in one fatal case, was three drachms.§

When introduced into the stomach of animals whose œsophagus had been tied, it produced violent attempts to vomit, hurried respiration, panting, tetanic convulsions, and death. The stomach was found much inflamed, and covered over with yellowish-white spots; the duodenum and jejunum were in-

* Christison, third edition, p. 221.

† Orfila's directions, p. 68. Probably this is the same case which is quoted from Dr. Montgarney's *Essai de Toxicologie*, in the London Medical Repository, vol. x. p. 511. "A lady, suffering from pyrosis, died in a few minutes after having swallowed a few mouthfuls of an aqueous solution of the sulphuret of potash. The fatal event was preceded by faintness, convulsions, and the issue of a yellowish froth from the mouth. On dissection, the stomach was found very much contracted: its internal membrane lined with sulphur, and of a brightish-red color; and its capillary system, in some points, minutely injected. The duodenum was red and inflamed, particularly toward its duodenal extremity. The superior portion of the small intestines, in about a fourth of its extent, presented the same appearances. The membrane of the mouth, pharynx, and bronchiæ was whitish and colored, but displayed no change of structure. The lungs were soft, not crepitous, and gorged with black, livid, and very fluid blood."

‡ Alcock on the Chlorurets, p. 115.

§ Christison, p. 222.

flamed; the lungs were partially gorged, and the left ventricle contained black blood. Vomiting was excited when the oesophagus was not tied.

When injected in solution into the jugular, it produced immediate tetanus, from which, in one instance, the animal quickly recovered, and in another he perished. The blood in the heart was fluid, and in the left ventricle of a deep-red.

The deduction drawn by Orfila from his experiments with this substance, is, that the corrosion excited by it is slighter in proportion as the dose is stronger, and the nervous phenomena will then be much more severe.

Liver of sulphur is decomposed by the acids, and sulphuretted hydrogen is given out. Corrosive sublimate, acetate of lead, nitrate of bismuth, and the salts of copper, all yield a black precipitate on the addition of a few drops of this substance; tartar emetic, an orange-yellow one; and arsenious acid, applied to a small quantity, a white precipitate; to a large quantity, a yellow one.*

Antidote. Vinegar was formerly recommended, but Dr. Chantourelle has found most benefit from the administration of chloride of sodium, (common salt,) in frequent doses. This decomposes the sulphuretted hydrogen, "whose rapid disengagement would seem to be the cause of death in the quickly fatal cases."

Sulphuret of soda, in the dose of half an ounce, produced gastritis, which was successfully combated by the usual means. In larger quantities, it would probably prove fatal.

* Devergie recommends the hydrochlorate of platina as a test. It gives a canary-yellow precipitate. (Vol. ii. p. 644.)

CHAPTER XVIII.

IRRITANT POISONS—(Continued.)

3. METALLIC COMPOUNDS. ARSENIC. *White oxide of arsenic*. Modes in which it may prove poisonous. Internally. (a.) Its exhibition by the mouth—symptoms—classification of these; when the patient dies between twenty-four hours and two or three days; when he dies in a few hours; when life is prolonged some days, or he survives. How small a quantity will induce death. (b.) By injection into the vagina or rectum. Externally. (a.) Applied to a wound or ulcer, or to the skin. (b.) By inhaling its vapors. Appearances on dissection—in the second variety of symptoms—in the first variety. The oxide of arsenic found partially converted into the sulphuret. Whether poisoning by arsenic delays or accelerates the progress of putrefaction. Cases. Effects on animals. Introduction of arsenic after death. Chemical proofs—specific gravity—solubility—taste—effects of heat. Taste of arsenic in the solid state; in solution; when mixed with organic fluids and solids, and with the contents and tissues of the stomach. Medico-legal cases. Discovery of arsenic many years after death. How far the symptoms only are a proof of the administration of arsenic. Antidotes and mode of treatment. Medical police. *Black oxide of arsenic*, or fly-powder—poisonous effects. *Arsenites*. *Arsenic acid*. *Arseniates*. *Sulphurets of arsenic*—effects—medico-legal cases—tests. *Arseniuretted hydrogen*. *Iodide of arsenic*. MERCURY. *Corrosive sublimate*. Effects. Internally, (a.) by the mouth—symptoms; (b.) by injection. Externally. Applied to a wound or ulcer, or to the skin. Appearances on dissection. Effect on animals. Tests in the solid state—fluid state—organic mixtures; the changes that it undergoes in the stomach. Medico-legal cases. Whether ptyalism is capable of a complete remission. Antidotes. *Red precipitate* and *red oxide of mercury*. *Nitrate*—cases. *Cyanuret of mercury*. *Mercurial vapors* and mercury in a state of minute division—cases. ANTIMONY. *Tartar emetic*. Symptoms—appearances on dissection—effect on animals—tests—antidotes. *Oxide*. *Muriate*. *Antimonial wine*. COPPER. *Metallic copper*—its ready oxidation. *Oxide* and *carbonate*. *Verdigris*. *Sulphate*. Symptoms—appearances on dissection—effects on animals—tests—antidotes. ZINC. *Sulphate*. Symptoms—appearances on dissection—tests. *Chloride*. Whether metallic zinc is a proper article for domestic utensils—for roofs. TIN. *Hydrochlorate*—effects—tests—antidotes. SILVER. *Nitrate*—effects—tests—antidotes. *Fulminating silver*. GOLD. *Nitro-muriate*—tests. *Fulminating gold*. PLATINA. *Nitro-muriate*. BISMUTH. *Nitrate*—effects

—tests—antidotes. IRON. *Sulphate. Muriate.* LEAD. *Acetate*—symptoms—effects on animals—doubts as to its poisonous qualities. *Carbonate*—symptoms—cases. *Litharge* and *red-lead*—effects. *Muriate.* Action of air and water on lead; articles of food or drink contaminated with lead; earthen vessels glazed with lead; action of vinegar, apples, milk on them. Adulteration of wines, cider, rum, cheese, sugar. *Saturnine emanations*—symptoms. Chemical proofs of the presence of lead. Antidotes. *Iodide of lead.* CHROME. *Chromate of potash*—symptoms—appearances on dissection—antidotes. MOLYBDENUM. TUNGSTEN. TELLURIUM. TITANIUM. OSMIUM. IRIDIUM. RHODIUM. PALLADIUM. NICKEL. COBALT. URANIUM. CERIUM. MANGANESE. CADMIUM. BARYTES, and its salts—effects—tests—antidotes.

IN revising the contents of the present chapter, and especially those relating to arsenic, I have endeavored to bring them within as small a compass as is compatible with a proper understanding of the subject. There is reason to fear that the numerous publications that have appeared of late years on it—sometimes crude, frequently discordant—have thrown shades of doubt on several points, which, for the due administration of criminal justice, should have been considered as established. At all events, the result, both in England and in this country, has been, that convictions for poisoning by arsenic have become more and more unfrequent, although the commission of the crime is proved to the satisfaction of the medical jurist.

The reader will, I trust, find a full exhibition of what is necessary to be done in order to detect the poisoner. Copious references are also given to enable him to prosecute more minute inquiries, and I have substituted them in the place of details, with the more freedom, since I can refer to independent treatises on poisons, as those of Orfila, Christison, and Taylor, which must be studied in order to become perfectly conversant with the whole science of the subject.

WHITE OXIDE OF ARSENIC. This substance, commonly known under the name of *arsenic*, is, according to chemical nomenclature, *arsenious acid*, or the *white oxide of arsenic*; and it has received these apparently incompatible names from the fact that, though more analogous to the oxides, yet it possesses some of the properties of an acid. It is usually obtained by roasting cobalt ores, which contain a notable proportion of arsenic. The vapors arising during the process of making

zaffre are condensed in a large chamber, and potash is added to them; the mixture is then sublimed, and the white oxide is obtained, leaving potash with sulphur. This employment is a dangerous, and in a short time, fatal one; and accordingly convicts, whose punishment would otherwise be death, are condemned to it.*

The principal chemical characters of this substance will be noticed under the head of *chemical proofs*.

Arsenic may be poisonous, whether internally or externally exhibited. 1. *Internally*, by the mouth, passing into the stomach, or by being injected into the vagina or rectum. 2. *Externally*, by being applied to a wound or ulcer, or by inhaling its vapors.

INTERNALLY. (a.) Its exhibition by the mouth.

In the previous edition I adopted a classification of the effects of this poison, as proposed by Hahnemann. He divides them into three degrees: When death follows the exhibition of the poison within twenty-four hours, it constitutes the first degree; and when later than twenty-four hours, the second; and when the case, though attended with dangerous symptoms, does not terminate fatally, it belongs to the third class.†

This arrangement, though very useful in increasing our knowledge of the complicated symptoms arising from the taking of arsenic, must, at the present period, give place to one more consonant with the advancing state of information. I shall accordingly follow that which was proposed in the Edinburgh Medical and Surgical Journal some years since, and which is used by the author in his subsequent work.‡ The cases are divided into three classes: 1. When the person dies between twenty-four hours and two or three days. 2. When he expires in five, six, or ten hours, or, at furthest, within

* Gordon's Inaugural Dissertation, p. 4. See a notice of this production in the Edinburgh Medical and Surgical Journal, vol. xi. p. 134. The dangerous nature of the vapors arising from the roasting of cobalt ores appears to have been early known. They were considered so hurtful to the miners, that a prayer was formerly offered up in the German church, that God would preserve miners from cobalt and spirits. (Beckmann, vol. ii. p. 263.)

† Edinburgh Medical and Surgical Journal, vol. vii. p. 86.

‡ Ibid., vol. xxi. p. 424. Christison, p. 270.

the first day. 3. Where life is prolonged six, eight, or ten days, or is saved altogether, but after some illness.*

1. The first case, or *where death ensues betwixt twenty-four hours and two or three days*, is the most common of all. The earliest symptom is sickness or faintness, and this often occurs within a few minutes after the poison is swallowed. But in a majority of instances, it does not happen for half an hour.† Pain in the region of the stomach succeeds, and this, most commonly, is a burning kind, and much aggravated by pressure. Violent fits of vomiting and retching came on, with dryness, heat, and tightness on the throat, creating an incessant desire for drink.‡ Hoarseness and difficulty of speech are commonly combined with these. The matter vomited is greenish or yellowish, but sometimes it is streaked or mixed with blood, particularly if the case be protracted beyond a day.

It must, however, be understood that the affection of the throat, as above described, is not always present; while again, it is sometimes so severe as to be attended with fits of suffocation and convulsive vomiting at the sight of fluids.

Diarrhœa generally, but not always, follows, or in its place are ineffectual attempts, and the abdomen is tense and tender, and sometimes also swollen. When the diarrhœa is severe, the rectum is commonly excoriated.§ Burning heat is felt at

* Dr. Christison has arranged the numerous cases on record according to this division, and selected their symptoms as given in the text. I will only add brief notices of American and recent European cases, for the purposes of confirmation or exception. My main aim (I repeat) in preparing the present article on arsenic is to simplify the subject. The discussions on it have been so voluminous, that there is not only danger of confusing it to the learner, but from the discrepancies of opinion, the lawyer may urge, as I have known to be done, that there is nothing settled on it. We shall, however, find that this, in all the leading and important points, is not the case.

† Several cases are quoted by Dr. Christison, in which the intervention of sleep appears to have delayed the appearance of this symptom for two, three, or even five hours.

‡ Mr. Taylor informs us that Professor Martini looks upon *extreme thirst*, when conjoined with dryness and constriction of the fauces, as affording the most certain evidence of irritant poisoning. It was present in four cases seen by Mr. Taylor, but in a fifth, it was absent. (Guy's Hospital Reports, vol. ii. p. 72.)

§ Occasionally, bloody purging is also observed. Dr. Merewether, of Ken-

the part, and the pain will extend along the whole course of the alimentary canal. Even the mouth and lips are inflamed, and present dark specks or blisters. The lungs are also affected in these instances. Shortness of breath, tightness across the chest, and, in a few cases, actual inflammation, have been the result.

There is frequently painful and difficult micturition. Some experimenters indeed assert that the urinary secretion is suppressed—it is probably diminished. The genital organs in both sexes are occasionally painful and swollen.

When the symptoms of irritation in the alimentary canal have subsided for some hours, convulsive motions often occur, such as tremors and twitches of the trunk, or the whole body; cramps of the legs and arms are also common. The pulse is feeble and rapid; the skin cold; clammy sweat breaks out; and the feet and hands are livid. The countenance betrays great anxiety; the eyes are red and sparkling; the tongue and mouth parched, and sometimes little white ulcers break out on the velum and palate.

Delirium sometimes accompanies the advanced stage, and stupor also is not unfrequent. Death, in general, comes on calmly, but is sometimes preceded by a paroxysm of convulsions.

In most cases the above symptoms are more or less uniformly observed, but there are some peculiarities and varieties which must also be stated.

Eruptions, either petechial or miliary, are not unfrequent in those who survive several days, but they are more generally

tucky, gives an instance where a female, aged sixty-four, took about forty-five grains of arsenic in biscuit. The early symptoms do not differ from those described in the text. There was, however, obstinate constipation, with bloody discharges of acrid mucus from the mouth and nose, probably from the violence of the vomiting. Œdema, with purple blotches on various parts of the body, succeeded, and the patient labored under intense suffering until the ninth day, when immense discharges of blood from the intestines, and delirium, preceded the fatal termination. The son of this female partook of the meal, and probably took double the quantity of poison. He was seized with vomiting and purging, and the usual symptoms, and gradually recovered. In both instances, soreness and swelling of the eyelids were present. (*Transylvania Journal*, vol. ii. p. 233.)

seen in chronic cases.* Swelling of the body, but particularly around the eyes, has also been noticed. Pain and vomiting are sometimes wanting, and even on pressure the former has not been recognized. Again, the pulse has occasionally been found very slow, not more than forty beats in a minute.

If death be somewhat retarded, there is not unfrequently a remission of all the distressing symptoms, and the patient is then in a dozing stupor. This usually happens about the second day, but it is merely temporary, and the symptoms return speedily with equal or increased violence.

It must be remembered that many cases are on record where this train of symptoms is followed by death in a few hours, from three to six, and yet the indications of irritation of the alimentary canal have been perfectly well marked during life, and verified by dissection after death.

2. The second variety of poisoning includes those cases in which death ensues in five or six hours, or a little more, at a period too early for inflammation to be always properly developed, and accordingly the symptoms are by no means so striking as in the first variety. On animals the effects were almost narcotic, as we shall see when noticing the experiments of Mr. Brodie, but in man they are far from being so distinctly marked.

In some instances of this kind vomiting occurs at the usual period after taking the poison, but it seldom continues. The most uniform effect is extreme fainting, amounting at times to deliquium. Occasionally there is some stupor, or rather oppression, and often slight convulsions. The pain at the pit of the stomach is slight, and seldom accompanied with the other signs of internal inflammation.

This variety of poisoning has been only observed under the three following circumstances: When the dose of the poison was large; when it was in little masses; or when it was in a state of solution.

* Dr. G. Bird mentions having seen two instances of the occurrence of eruptions (pale papular) on the skin. They appeared on the second and third days after taking the arsenic. (Lancet, N. S., vol. xxxiii. p. 99; Lancet, October 21, 1843.)

Dr. Christison quotes nine cases of this variety, and they sufficiently prove that arsenic does not always, in fatal cases, produce violent and well-marked symptoms.*

3. *The third variety is when life is prolonged six, eight, or ten days, or even is saved, after some illness.* Here the early symptoms are the same as those of the first or inflammatory variety, but the subsequent ones are referable to nervous irritation. They generally come on when the former begin to recede, yet they sometimes make their appearance while the symptoms of inflammation are still violent. They vary in different individuals, from coma to an imperfect palsy of the arms and legs, and between these extremes are observed epileptic fits or tetanus. Thus in Dr. Roget's case, after recovering from the ordinary effects, the patient was seized with epileptic fits on the sixth day, and they returned occasionally until the nineteenth.† In Mr. Turner's family, supposed to be poisoned by Eliza

* I subjoin for comparison, a number of cases collected by Christison and myself:—

1. Dr. Smith, New York Medical and Philosophical Journal, vol. iii. p. 6. *Eighteen hours.* Dr. Christison says *eight*; but on referring to the original, the other will be found to be correct.

2. Metzger. Christison, p. 287. *A few hours.*

3. Dr. Christison, Edinburgh Medico-Chirurgical Transactions, vol. ii. p. 298. *Five hours.*

4. London Medical and Physical Journal, vol. xxxiv. *Five hours.*

5. Dr. Gerard, Revue Médicale. *Five hours and upwards.*

6. Orfila, Archives Générales. *Nine hours.*

7. Mr. Holland, London Medical Gazette, vol. xv. *Eight hours.*

8. Chaussier, Orfila's Toxicology. *A few hours.*

9. Mr. Macaulay, Christison, p. 289. *Two hours.*

10. Mr. Wright, Lancet, vol. xvi. *Four hours.*

11. Morgagni. *Twelve hours.*

12. Laborde, Journal de Médecine. *Nine hours.*

13. Dr. Gould, Boston Medical Magazine. *Seventeen hours.*

14. Mr. Coates, London Medical Gazette, vol. xx. *Four hours.*

15. Mr. Joseph Thompson, Lancet, No. 792. *Six hours.*

16. Mr. Pettigrew. See his life in the Medical Portrait Gallery. *Seven hours.*

In Mr. Wright's case, an ounce of arsenic was taken, in Mr. Coates' two ounces; and in Mr. Macaulay's, Dr. Christison says, "the individual died with narcotic symptoms only, within two hours, after taking nearly a quarter of a pound of arsenic."

† Medico-Chirurgical Transactions, vol. ii. p. 134.

Fenning, twitches, numbness, and epileptic fits occurred in different individuals. Pyl mentions a case where tetanus was present, and partial palsy of the extremities has been noticed by De Haen, Mr. Murray, of Alford, Professor Brent, Dr. Falconer, and others.*

Among the occasional results, when life is saved, are irritability of the stomach, attended with constant vomiting of food, loss of the hair, and desquamation of the cuticle.

Mr. Furley, of London, mentions several cases in which *ptyalism* appears to have been produced by arsenic, when taken in the form of Fowler's solution. Soreness of the gums, swelling of the tongue, etc. were present. This effect appears to have been produced in one case on the fifth day, and in others later.† "Even if continued in very small doses," says Dr. Elliotson, "it will produce occasionally the first stage of gastritis. The disorder of the stomach is of very long continuance. I knew a lady who took arsenic ten years ago, and she has never recovered from its effects on the stomach."‡

Soreness and inflammation of the eyes are frequently mentioned as occurring.§

How small a quantity of arsenic will cause death? In the

* Edinburgh Medical and Surgical Journal, vol. xviii. p. 167; Memoirs of the Medical Society of London, vol. ii. p. 224; Bedingfield's Compendium, p. 115; Dr. Dunnell, New York Medical and Physical Journal, vol. ix. p. 114; Lachese, Annales d'Hygiène, vol. xvii. p. 337.

† London Med. Gazette, vol. xvi. p. 790. Mr. Pereira (ibid., vol. xviii. p. 167,) observes that Marcus, in the Ephemerides for 1809, has also noticed this effect. See also a case by Mr. Jones, in ibid., vol. xxvi. p. 266.

‡ London Medical and Surgical Journal, vol. ix. p. 725. Dr. Burne relates a case in which one-fifth of a grain of arsenic, taken in divided doses during three days, induced gastritis. (London Med. Gazette, vol. xxv. p. 414.)

§ Dr. Ramsey, of South Carolina, saw twelve cases in one family, who were all poisoned from putting arsenic into soup. They were seized *immediately* after eating it. Vomiting occurred in all. The bowels were affected in some, while in others they were torpid. In one person, a female aged fifty, painful micturition, black and offensive stools, and pain about the rectum were present, and during the night there was a free menstrual discharge, although that evacuation had ceased five years previous. None of them died. Swelling of the face, eyelids, and joints of the fingers were secondary symptoms in several of the children. (American Journal of Med. Sciences, vol. xv. p. 259.) See also Dr. Elliotson's Lectures, London Med. Gazette, vol. x. p. 6.

previous edition I mentioned that *two grains* were deemed sufficient. This was stated on the authority of Hahnemann. Dr. Christison remarks that the smallest actually fatal dose that he has found recorded is four and a half grains. The subject was a child four years old, and death occurred in six hours. Renault, however, destroyed a large dog by a single grain in solution, in four hours, while the same quantity, dissolved in wine, produced severe effects in several persons, although it was taken after dinner.* These circumstances are a sufficient warrant for allowing the above statement to remain.†

(b.) *By injection into the vagina or rectum.* This is fatal in the same way as already described, but the inflammation affects the intestines more than the stomach.

A female in 1799, in the department de l'Ourthe, in France, aged forty, died after a short illness, which was accompanied by a considerable tumefaction of the genitals, by uterine hemorrhages, vomiting, and abundant purgation. This woman confided to two of her neighbors that her illness was occasioned by powdered arsenic, which her husband, *in concubito*, had himself insinuated into the parts. The body was examined by the proper officers. They declared that they found the vulva and vagina in a state of gangrene, the abdomen much distended with air, and the intestines inflamed and gangrenous. The culprit was arrested, convicted, and executed.‡

Another case happened in Finland, in 1786, and is related by Dr. Mangor, of Copenhagen. Here arsenic was mixed with flour, and introduced up the vagina. Three wives in succes-

* Edinburgh Medical and Surgical Journal, vol. xxxiii. p. 67. Professor Lachese, of Angiers, from a comparison of the effects produced in several cases that came under his observation, draws the following conclusions: That arsenic, taken to the amount of one-eighth of a grain by a healthy and adult man, may prove injurious; that in the dose from a quarter to half a grain, it may induce symptoms of poisoning, and that from one to two grains may cause death. (*Annales d'Hygiène*, vol. xvii. p. 350.)

† The symptoms do not appear to bear any *uniform* relation to the *quantity* or form of the poison. (Taylor, p. 326.) For a discussion of many anomalies presented by symptoms in various cases, see a paper by Dr. Ogston, *Med. Gazette*, vol. xlvii. p. 181.

‡ London Medical Repository, vol. ix. p. 246.

sion were poisoned in this manner. With the third, the crime was perpetrated at 7 A. M., and at 3 P. M. she was seized with shivering and coldness of the body, and at the same time a burning heat of the vagina. Her sufferings were intense; she became delirious at 11 P. M., and died at midnight. The only means used for recovery was the repeated injection of milk. On dissection, the labia were found tumid and red, the vagina gaping and flaccid, and although this part had been repeatedly washed by the injections, yet grains of arsenic were found adhering to it. The os uteri was gangrenous, the duodenum inflamed, the stomach natural, and the lungs quite livid. The other parts were all healthy. The blood was fluid throughout the body.*

As to the effect of injecting arsenic into the rectum, a case is cited at page 442 of this volume.

In one experiment on a dog, forty-eight grains of arsenious acid, in the form of powder and fragments, were introduced into the rectum. He shortly after passed the whole of it by stool. Two days after, the same quantity, but pulverized, was introduced. This produced loss of appetite and dejection, and he died in eight days. The parts round the anus were exco-riated, and the integuments detached, so that there was an ulcer of some extent. The mucous membrane of the intestines, near the anus, was of a greenish gray, and above it of a bright red, for the space of six or seven inches; but in ascending upward, it gradually diminished in intensity.†

* Gordon's Dissertation; Davis' Obstetric Medicine, p. 132; Christison, p. 292. It is also mentioned that the Copenhagen College of Medicine, when this case was referred to them, and when some doubted the possibility of this mode of poisoning, made some experiments by introducing arsenic into the vagina of mares. It produced inflammation, tumefaction, and death. On dissection, the genital parts were found gangrenous, and there was an effusion of bloody serum in the abdomen, with traces of inflammation in the stomach, intestines, lungs, aorta, thoracic duct, etc. (London Medical Repository, vol. ix. p. 246, from the Journal de Médecine.)

† Orfila's Toxicology, vol. ii. p. 541.

EXTERNALLY, (a.) *Applied to a wound or ulcer, or even to the skin.*

Of this there are some instructive cases on record. Dr. Desgranges relates the following:—

A chambermaid had been so imprudent as to rub her head with an ointment containing a portion of arsenic, for the purpose of destroying vermin. Her head was perfectly sound, without the least scratch. But in six or seven days after, it began to swell; the ears, which were twice their natural size, became covered with scabs, as were also several parts of the head; all the glands of the jaw and neck rapidly enlarged; the face was tumefied, and almost erysipelatous. Her pulse was hard, tense, and febrile; the tongue parched, and the skin dry. To these were added excruciating pain and a sensation of great heat. Vertigo, fainting, cardialgia, occasional vomiting, thirst, ardor urinæ, constipation, trembling of the limbs, and delirium, were also present. Dr. Desgranges treated the complaint as an inflammatory disease, and in a day or two after, the body, and especially the hands and feet, were covered with a considerable eruption of small pimples with white heads, like millet. This eruption, in time, dried up and desquamated, and she finally recovered, but during her convalescence the hair fell off.*

Belloc has recorded a similar instance: A female, aged fifty-six, in good health, but of a delicate constitution, had the imprudence to wash her body with a solution of arsenic in water, to cure the itch. Her body swelled prodigiously, and she was covered with an erysipelatous eruption. She dragged out a painful existence for two years, but during life was always afflicted with a trembling of the limbs.†

Roux amputated the scirrhus breast of a girl of eighteen. The wound did well, but while rapidly closing, an ulceration, accompanied with slight darting pains, made its appearance in the centre. He applied the *arsenical paste*, as it is called in France, and of which arsenious acid is the basis. The day after she was seized with violent colic, and experienced some

* Foderé, vol. iv. p. 123.

† Belloc, p. 121.

vomiting. Two days afterwards she died in violent convulsions. The body, which was covered with large ecchymoses, quickly putrefied, and, on opening it, the internal surface of the stomach and a great part of the intestinal canal were found in a state of inflammation, and sprinkled over with black spots.*

Dr. Hosack also relates an instance in which a palsy of the muscles of the neck and right arm was occasioned by its application to an encysted tumor.†

There can be no doubt that the various quack preparations used both in England, France, and this country, for the cure of cancer, and which have arsenic for their base, have, in many cases, proved destructive to the patients. Certainly governments ought to interdict their application, except in the hands of regular practitioners.‡

* Orfila's Toxicology, vol. i. p. 124. A case by Dr. Kuchler, where death followed in ninety-six hours after the application of arsenical paste to a fungous tumor on the temple, is quoted in the American Journal of Pharmacy, vol. ix. p. 75, from the Archives Générales. There are, however, exceptions to these injurious and fatal effects. In some instances, no bad consequences are produced, and the result of the application of arsenic is merely the formation of an eschar. For this difference two causes have been assigned. One is the relative quantity employed, a small portion being most readily absorbed, and producing constitutional disease, while a large quantity quickly destroys the organization of parts, and prevents absorption. Another has been pointed out by Harles. He observes that arsenic "may be applied with safety to the abraded skin, to common ulcers, to wounded surfaces, and to malignant glandular ulcers, even when highly irritable, provided the part be not recently wounded so as to pour out blood." Here the poison is applied to an open-mouthed vessel, and the effect, as we shall see when stating the result of experiments on animals, is rapid and destructive. (Christison, p. 290.)

† American Medical and Philosophical Register, vol. iii. p. 389. Another fatal case from its application to a tumor, at the angle of the jaw, is given by Dr. Hoit. (New York Medical and Physical Journal, vol. iii. p. 375.)

‡ In France, the *pâte arsenicale* is used. It consists of cinnabar seventy parts, sanguis draconis twenty-two, and arsenious acid eight, made into paste at the time of applying it. In England, *Plunkett's ointment*, made of arsenious acid, sulphur, and the powdered leaves of the ranunculus flammula and cotula fetida; and *Davidson's remedy for cancer*—arsenious acid and powdered hemlock. (Paris' Pharmacologia, p. 209.) In the United States, *Davidson's cancer plaster*—some preparation of arsenic. As far back as the time of Haller, cases are related of death ensuing from the external application of arsenic to cancers and ill-conditioned ulcers. (Edinburgh Medical and Sur-

During the period of the plague of London amulets of arsenic were worn suspended over the region of the heart as a preservative against infection. Even this proved dangerous, and Dr. Mead severely reprehends it. [Shepherds have been poisoned in consequence of applying arsenic to sheep for the purpose of destroying the fly.]*

(b.) *By inhaling its vapors.*

I have already adverted to the effects produced on the miners in Germany, and will now mention those caused in the copper smelting works of Cornwall and Wales, in consequence of that metal in its crude state being mixed with arsenic. Dr. Paris states that in their vicinity "horses and cows commonly lose their hoofs, and the latter are often seen in the neighboring pastures crawling on their knees, and not unfrequently suffering from a cancerous affection in their rumps, while the milch cows, in addition to these miseries, are soon deprived of their milk. The men employed in these works are more healthy than we could *a priori* have supposed possible; but the antidote on which they rely with confidence, whenever they are infected with more than an ordinary portion of arsenical vapor, is *sweet oil*, and an annual sum is allowed by the proprietors, in order that it may be constantly supplied."

It deserves notice, he adds, that the smelters are occasionally affected with a cancerous disease in the scrotum, similar to that which infests chimney-sweepers.†

The effects of the vapors of arsenic in the laboratory are no less marked. "While Tachenius," says Van Swieten, "endeavored to fix the arsenic by repeated sublimations, the vessels being open, he inspired a very sweet air, but in a half hour felt the consequence of his imprudence. He not only breathed with difficulty, but suffered convulsions in all the members of his body, and passed bloody urine with great pain."‡ Dr. Gordon mentions the following as occurring to himself: While

gical Journal, vol. xiv. p. 643.) A fatal case is mentioned in *Annales d'Hygiène*, vol. xi. p. 459, and another in *Edinburgh Med. and Surgical Journal*, vol. lxiii. p. 241. Here the chemical examiner found arsenic in the breast, and minute portions in the tissues of the liver, stomach, and spleen.

* *Lancet*, September, 1857, p. 282.

† *Paris' Pharmacologia*, p. 209.

‡ Gordon, p. 15.

sublimating arsenic, the vessel broke, from the heat, and on removing it hastily from the fire he inhaled a small quantity. A sense of pain and tightness about the præcordia was immediately felt, with a difficulty of breathing and violent cough. The pulse was weaker and quicker than natural. On the next day, all the symptoms were gone except the cough, nausea, and anorexy. These were removed by a cathartic.*

Appearances on dissection. These are generally found to vary with the length of time that the patient survives. If death ensues within a few hours, no opportunity is allowed for the development of local inflammation, and its marks are accordingly absent.

In this then, the *second variety*, described under the head of symptoms, the most marked character is the absence of diseased appearances. In the cases there quoted, hardly anything beyond a slight local redness of the villous coat of the stomach was noticed. In Dr. Smith's case, there was merely redness at the pyloric end. In Dr. Gould's, nothing was seen but two or three red patches near the cardiac extremity. Particles of arsenic were, notwithstanding, picked from the mucous coat.

It must, however, be distinctly understood that although this absence of morbid appearance is most common in those who die within a few hours, yet there are many instances of that description in which the marks of inflammation are distinctly developed, and this will generally be indicated by the violence of the symptoms during life.

* Gordon, p. 16. I subjoin the following: "While a gang of stavedores were engaged in hoisting some casks of powdered arsenic from the hold of the packet-ship Quebec at New York, several of them slipped from the slings, and broke. The arsenic being scattered over the hold of the vessel, these men were employed to sweep it up. At about the same instant, several of them were seized with vertigo, and fell senseless. Soon afterwards all were attacked with violent vomiting, which was speedily succeeded by the more severe symptoms of poisoning by the metal. Two or three of the cases (in all nine) proved fatal in the course of a few days. Several of them returned to work at the expiration of a week." (Dr. Vandervoort, in New York Journal of Medicine and Surgery, vol. ii. p. 483.)

Dr. G. Bird relates the case of an enameler, exposed to the fumes of arsenic, in whom bloody vomiting and purging occurred, with gastroenteritis and pneumonia. (Lancet, October 21, 1843.)

In a case related by Mr. Hebb, where death ensued in four hours, the internal coat of the stomach was much attenuated and exceedingly vascular, while underneath it was a number of specks of extravasated blood. The peritoneal coat also was inflamed.*

The appearances observed in the *first variety*, or where life is prolonged till the second day or later, are as follows:—

Redness of the throat and œsophagus. This has been found in animals, and, in a few cases, in man. In one instance the tongue was inflamed and thickened.†

The inner coat of the stomach is very commonly inflamed, its peritoneal one but seldom. Corrugation of the stomach is a common appearance. In several instances, the villous coat has been found black, from effusion of altered blood into its texture. “When the color is brownish black, or grayish black, and not merely reddish black, when the inner membrane is elevated into firm knots or ridges, by the effusion, and the black spots are surrounded by vascularity or other signs of reaction, these appearances strongly indicate violent irritation.”‡ They are probably not imitated by any pseudo-morbid phenomenon. The villous coat is also often unusually soft, brittle, and easily separable by the nail; but this is not constant. It has been seen thickened, raised, and corrugated, owing in several instances to the effusion of blood under it.

Erosion, or perforation of the coats of the stomach, is only an occasional occurrence. It is hardly to be looked for, according to Dr. Christison, unless the patient survives nearly two days.§ The change that is designated by these terms, is,

* Midland Med. and Surgical Reporter, vol. i. p. 334. So in Mr. Thomson's case, already referred to, the mucous membrane of the stomach was highly injected with some dark spots of extravasation. The lungs were extremely gorged, and the pia mater greatly congested, while the sinuses of the brain were full of black blood. See also Mr. Watson's case, where death occurred in nine hours. (Edinburgh Med. and Surgical Journal, vol. liii. p. 400.)

† The lining membrane of the larynx and trachea was highly injected, and the œsophagus inflamed, in a case that occurred to Mr. Taylor.

‡ Christison, p. 302.

§ In a case, however, that occurred to Mr. Taylor, where death ensued in *seventeen* hours after taking the poison, there was extensive ulceration of the mucous membrane of the stomach.

strictly speaking, either an ulceration, in which the little cavities have an irregular shape and are surrounded by a red areola and a margin of firm tissue, or an actual gelatinizing or softening.

It is highly probable that observers have been mistaken in supposing that sloughing or gangrene of the coats of the stomach is ever a consequence of this poison. The black extravasated patches on the villous coat resemble it in everything but the fœtor. According to Mr. Brodie, a preparation in John Hunter's museum, designed to show a slough of the villous coat caused by arsenic, proves to be nothing else than an adhering clot.*

The mucous secretion of the stomach is almost always greatly increased in quantity. It is either thin and glairy, or solid, as if coagulated, and in the latter case it presents itself under the varieties of a uniform attached pedicle, or of loose shreds floating among the contents. Sometimes the matter effused is true coagulable lymph. Blood, or a bloody fluid, is not uncommon.

In many instances, solid arsenic has been found adhering to the coats of the stomach, either in loose particles, or enveloped in coagulated mucus, or in little clots of blood, or wrapped up in the more solid parts of the contents, and this, too, in spite of long-continued and violent vomiting.† In no less than six

* Christison, p. 305.

† The following remarkable case is cited by Dr. Horner, (*Pathological Anatomy*, p. 297,) from Laennec:—

“A girl, in a moment of violent grief, swallowed an ounce of arsenic, but escaped very unexpectedly from its effects. The following year, being in a similar state of mind, she took it again and died. On dissection, the effects of the recent dose on the stomach were very obvious, and besides these, a cyst was found, which seemed thus detached from the vicinity of the pylorus, where the traces of its adhesion were still perceptible. This cyst contained an ounce of arsenic, crystallized, and had the consistence of a false membrane. It was supposed to have been formed around the arsenic by the sudden inflammation which followed the first dose, and that the patient owed her preservation to its enveloping the poison.”

It is possible that other appearances in the stomach may be mistaken for solid arsenic, and I therefore add the following from Mr. Pereira's *Lectures*. (*London Med. Gazette*, vol. xviii. p. 194.)

Orfila, in the second edition of the *Dictionnaire de Médecine*, art. *Arsenic*,

cases, four of which came under his own notice, and one under that of his colleague, Professor Traill, Dr. Christison found the oxide of arsenic to be partially converted into the *sulphuretted*, and thus both may be present at the same time. For our knowledge of this curious fact, we are altogether indebted to Dr. Christison. The presence of sulphuretted hydrogen in the stomach is doubtless the cause of this conversion.*

Redness of the coats of the intestines is not uncommon, but ulceration is a rare occurrence. The duodenum has sometimes been found affected in a similar manner to the stomach, with its inner coat dark red, pulpy, and thickened, and portions of it wanting. Beyond the duodenum, there are seldom any distinct marks of inflammation observed until we reach the rectum.† Drs. Baillie and Male have each seen it inflamed, excoriated, and ulcerated.

observes: "Under certain circumstances, the mucous membrane of the stomach and intestines is lined with a multitude of brilliant points, composed of fat and albumen. These grains, when placed on burning coals, decrepitate on drying, and produce a noise which has been improperly denominated *detonation*; they inflame as a fatty body when they contain a notable quantity of fat, and exhale an odor of burned animal matters. These fatty and albuminous globules may be met with in the bodies of individuals who have not been poisoned, and require attentive examination in order to distinguish them from arsenious acid. The best method of avoiding this error is to digest the granular parts with water, and to apply the tests proper for demonstrating the existence of arsenious acid."

* Christison, third edition, p. 316. Another case, corresponding in every respect to the above, is given by M. Boissenot, in *Journal of Pharmacie*, vol. xxiii. 614.

See also Devergie, vol. ii. p. 732; Hedley's Case in *Lancet*, September 2 and 3, 1843. Mrs. Smith's case, given hereafter, who was poisoned by red arsenic, (realgar,) which was found in a state of orpiment. Again, Mr. Herepath, of Bristol, found in the case of Scaley, poisoned nine months previous by arsenious acid, and then disinterred, the whole of it converted into orpiment; and in another instance, after eleven weeks, partially so. From experiments on animals, he has ascertained that it produces a combination of the orpiment with animal matter. (*Chemist*, vol. v. p. 230.) See also *Gazette des Tribunaux*, April 24, 1845.

† Erosion or perforation of the intestines was noticed in Mr. Sandell's case, where the person died in a week, and the body was disinterred one hundred and forty-one days after death. This is probably a unique case. (*Lancet*, September 2 and 9, 1843.)

The colon has been found remarkably contracted in several instances. See Houlston, *London Med. Gazette*, vol. xiv. p. 712; Dr. Booth, *ibid.*, p. 62.

Redness of the pleura, and even inflammation of the lungs, are not uncommon consequences of the taking of arsenic. Instances are given by Pyl and Henke, in which the lungs were in the highest state of congestion and inflammation, so that when cut into, nothing but clotted blood could be seen in their cellular structure.

In a case examined by Orfila at Paris, where death ensued in forty-eight hours, from eating poisoned sausages, the left cavities of the heart were of a mottled-red hue, and in the ventricle, especially on its columnæ, were many small crimson specks which penetrated into the muscular part. The right cavities had a deep reddish-black tint, and the ventricle of that side contained specks like those in the other, but more faint. Orfila adds that he had previously noticed the same appearances in animals.*

The external organs of generation, in both sexes, have been found distended and black; and in one case, occurring to Bachmann, those parts in a female were surrounded by gangrene.†

The blood, according to Mr. Brodie, is commonly fluid in animals killed by arsenic, and this is confirmed by other observers. Harles, on the authority of Wepfer, Sproegel, and Jaeger, says it is black, semi-gelatinous, and sometimes pulta-

* London Med. Repository, vol. xx. p. 349. Mr. Cooke observed an appearance of deep redness, almost as if extravasation had taken place, beneath the internal lining of the right ventricle, in an individual who survived five hours after taking arsenic, and who, during that time, suffered much from pain and vomiting. The inner surface of the aorta, for about an inch from its commencement, was not only of a deep-red color, but spots of lymph adhered to it. (Cooke's Morgagni, vol. ii. p. 587.)

Mr. Page, in the case of a boy, three and a half years, who had apparently recovered from the immediate effects, but who was seized on the fourth day with slight difficulty of breathing, quick pulse, anxiety of countenance, unaccompanied with pain, sickness, or purging, and gradually sunk until his death on the sixth, found coagulable lymph in the ventricles and in the venæ cavæ near the auricle. The walls of the heart were pale, flabby, and soft. (Lancet, N. S., vol. xx. p. 626.)

† "In a case related in Pyl's collection, the inside of the uterus, and even the Fallopian tubes, were found inflamed." (Medico-Chirurgical Review, vol. xxxiii. p. 373.)

The kidneys are sometimes highly vascular, and the bladder contracted and empty.

ceous. It has, however, been found coagulated, in animals dead from this poison, by Dr. Campbell and others. On the human subject, the observations are very few and very discordant. Thus, of three cases where it was noticed, in one it was black and coagulated; in another, black and fluid; and in the third, florid and fluid.

The external appearance of the body varies with the length of the illness; if protracted, we may expect earlier and more extensive lividity; and there are also some cases where œdema is distinctly manifested. It is a curious problem, *whether arsenic delays or accelerates the progress of putrefaction* in bodies poisoned with it. Formerly it was the universal opinion that the process proceeded more rapidly in consequence of this. At the present day, however, its known antiseptic qualities when applied to animal substances, and the investigation of some remarkable medico-legal cases, have induced a different belief. Dr. Christison has made the English public acquainted with these. They occurred in Germany, and were previously only published in the language of that country.

The first occasion on which this property of arsenic was brought into public notice was about the beginning of the present century, in the course of the trial of the Widow Ursinus. Previous to this, Dr. Welper, then medical inspector at Berlin, having remarked that the body of a person poisoned with arsenic remained quite fresh for a whole week in summer, attended carefully to this subject at every opportunity, and invariably, he says, found the body resisted putrefaction. In 1803, he was engaged in investigating the case of the female above named. Having been discovered in an attempt to poison her servant, suspicions arose concerning the previous sudden death of three persons in her family—her husband, a young officer her paramour, and an aunt from whom she derived an inheritance. They had all died in mysterious circumstances, and this lady had been their nurse. Dr. Welper disinterred the bodies of the husband and aunt, which had been buried, the former two years and a half before at Berlin, the latter six months afterwards at Charlottenberg, and he found them not putrid, but dried up. No arsenic could be detected.

At the request of Dr. Welper, similar experiments were

made on animals by Dr. Klank, and with results strikingly conformable. Dogs poisoned with arsenic were buried in a damp cellar, and their bodies sometimes exposed to its air; yet at the end of three years, they continued dry and undecaying.

Another trial arose in Bavaria from the following circumstances:—

A lady, near Bayreuth, died after five days' illness, under symptoms of violent general irritation of the alimentary canal. In a short time suspicions were excited, and the supposed criminal was implicated so far as to be also suspected of having poisoned two other persons. The bodies of the three individuals were accordingly disinterred; one of them five months, another six months, and the third fourteen months after death. In all of them the external parts were not putrid, but hard, cheesy, or adipocirous; in the two last, the stomach and intestines were so entire as to allow of their being tied, taken out, cut up and handled; and in one a sloughy spot was found in the region of the pylorus. Arsenic was detected in two of the bodies by Rose's process of analysis.*

The following recent case was communicated to Dr. Christison by Dr. Traill: "The master of a foreign vessel died in about twenty-four hours, apparently of, malignant cholera, at a small port in the neighborhood of Edinburgh, and the body was forthwith buried. A suspicion having, however, arisen in his native country that he had been poisoned by his mate, an inquiry was instituted at the request of the foreign government, and the body was disinterred *five months* after death. The face and neck were swollen, black, and decayed, but the rest of the body was quite free of the usual signs of putrefaction. The skin was white and firm, the muscles fresh, the lungs crepitating, the liver and spleen were shrivelled, the stomach and intestines entire through their whole tissue, and capable of being handled freely without injury. On the mucous coat of the stomach several dark patches of extravasation were found, likewise several spots and large patches, presenting on their

* This case (which is quoted from Bachmann) and the preceding are taken from Christison, p. 312, etc.

surface a firmly adhering bright-yellow crust, and the contents of the stomach consisted of a considerable quantity of yellow sandy matter, of the consistence of paste." On analyzing these contents and crusts, they were found to consist chiefly of oxide of arsenic partially converted into sulphuret in the manner already noticed when considering the appearances observed on dissection.*

I shall have occasion to revert to this subject when speaking of the detection of the poison by chemical tests in bodies interred for a length of time.

But this preservation of the animal textures does not occur in all cases of poisoning with arsenic; and it therefore becomes a question why bodies sometimes run rapidly into putrefaction, while at other times its progress is thus either delayed or prevented. The diversity is supposed, by Dr. Christison, to be owing, in the former instance, to the discharge of most or all of the arsenic by vomiting; and he suggests that this circumstance, in consequence of the unnatural supply of moisture and the incipient disorganization, may even induce an earlier decay of the stomach than of other parts. It is also probable that the place of burial, the nature of the soil, and the condition of the air, exercises a material influence.

Effects on animals. This subject deserves consideration, from the aid it may afford in determining on the nature of the symptoms and morbid appearances in the human system. Several able observers and experimentalists have directed their attention to it.

Dr. Jaeger, of Stuttgart, examined the effects of this sub-

* Christison, third edition, p. 326. It is supposed by some that the substance used by Ruysch, in his anatomical preparations (the secret of which died with him) was arsenic. "Mr. William Pettigrew has been in the habit, in the course of his dissections, of injecting into different parts of the human body a weak solution of arsenic, the effect of which is to resist putrefaction, and render haste unnecessary in the pursuit of anatomical inquiry. He has found a limb, at the expiration of two months, as well fitted for the purposes of dissection as at the time usually selected after decease." Pettigrew's Medical Portrait Gallery; Life of Ruysch.) See also some striking instances of the preservation of bodies by injecting arsenical solution into the blood-vessels, in Dunglison's Medical Intelligencer, vol. ii. p. 337, from the Calcutta Quarterly Journal.

stance on all classes of organized bodies, vegetable and animal; and most of his experiments were made with a solution of the white oxide in water, in the proportion of one to sixteen. He found it a general and quick poison for plants at every period of their life, with the exception perhaps of a few of the simplest forms of vegetable existence. Their various parts died in succession as the particles of the poison reached them. In animals, death was preceded in every instance, from the infusory animalculæ up to man, by inordinate motions; and the secretion of lymph was increased most remarkably from the mucous membranes. Frequent fluid stools took place in all classes of animals; in those in which mucus is secreted on the surface, it was remarkably increased, and crabs ejected a great deal of froth from the bronchial openings. The power of voluntary motion, and susceptibility for external stimuli, decreased; the respiration of those animals which breathe by lungs became difficult and laborious, and warm-blooded animals experienced extraordinary thirst. In birds and mammalia, frequent and violent vomiting took place, and commonly was the commencement of the scene to which convulsions put an end. Rabbits, however, which ruminate, did not vomit.

Arsenic exerted the most powerful effects when it was injected into the veins, or applied to a bleeding wound;* next when it was introduced into the stomach, but less so when it was injected into the large intestines, which have fewer absorbing vessels. Applied to the sound skin, and to a wounded muscle, if dry, it seldom produced any effect; and animals covered with scales or shells did not suffer at all from the ex-

* There can be no doubt of the truth of this statement. Dr. Gordon quotes the following experiments, given to him by his friend, Dr. Campbell, which prove how a *small* quantity, *externally* applied, is sufficient to destroy life: Five drops of a saturated solution of the white oxide of arsenic were placed in a wound in the neck of a young cat. The animal was seized with vomiting, and died in four days. The stomach internally was much inflamed near the pylorus, and the small intestines were also greatly inflamed, both internally and externally. In another instance, two drops of *arsenious acid* (the effects of which only differ in being more powerful and rapid) were put on the head of a cat, and she was dead in twenty-four hours. Vomiting took place, and the stomach and œsophagus were inflamed. (Gordon, p. 19.) It is also confirmed by Mr. Brodie's experiments.

ternal application of arsenic. Applied directly to the nerves, it was inert. Lastly, he found that animals were never killed more certainly or quickly by arsenic, than when it was injected into the abdomen; but upon this he lays no stress, as the same effect was produced by most infusions.

In whatever way the arsenic was applied, Dr. Jaeger observed after death no change upon the skin. The gullet, and in birds the crops also, exhibited generally a slight redness; and farther down, purple-red stripes, more numerous in the vicinity of the cardia, which, as well as the stomach itself, in animals having a soft villous coat to their stomachs, was sometimes of a uniform purple-red color, and sometimes spotted with it. The muscular stomach of graminivorous birds, however, showed no appearance of redness; and in the aponeurotic portion of the stomach of a horse poisoned by arsenic, there were no traces of inflammation, which was otherwise general. The villous coat of the stomach is almost always softened, and as if macerated, and also somewhat swollen; and in general it can be easily torn or rubbed off in pieces with the finger, from the coat beneath it. The inflammatory redness is not seated in the villous coat, which remains perfectly white, but in the nervous coat, which is remarkably red, and exhibits everywhere purple-red warts or eminences. The author, however, often saw this separation of the villous from the nervous coat, without any inflammatory redness of the latter. These changes continue, though in a less degree, through the small to the vicinity of the large intestines, which are in general free from them, and only contain an increased quantity of effused mucus; but the rectum again is inflamed, and its inner coat swollen and softened. These appearances are not constant, and are very various in degree.

The other mucous membranes were less generally affected, but he sometimes found the trachea red and inflamed, and in one instance the urethra of a dog. In no instance was there real inflammation of the peritoneum, but its vessels were always turgid with stagnating blood. The voluntary muscles were constantly and universally rigid; the limbs sometimes bent, but generally extended; the heart, urinary bladder, gall-bladder, and intestines, were rarely contracted, but frequently

distended by their contents. The veins, especially of the abdomen, were constantly turgid with much black fluid blood, and a similar stagnation was observed in the cavities of the heart, especially of the right side. The lungs in general were natural, as was also the brain.

Putrefaction seemed neither to be hastened nor retarded by their being poisoned with arsenic, whether they were buried or not.

He, however, remarked that the immediate contact of the arsenical solution seemed in some degree to retard the putrefaction of the part to which it was applied in sufficient quantity.

As to the local effects of arsenic, he observed that when applied to the sound skin it seldom injured it. If applied to a wound, it never, after death, was observed to be gangrenous or inflamed; was rarely swollen, but generally pale; and for a considerable extent the subcutaneous cellular membrane was filled with much stagnant, gelatinous fluid. The œsophagus, stomach, and intestines, were commonly though not always inflamed, when arsenic was administered by the mouth. He never noticed real erosions, ulcerations, or gangrene of the viscera. In the horse already mentioned, into whose jugular vein two ounces of arsenical solution were injected, and which was put to death twenty-nine hours afterwards, there were only some discolored spots in the left ventricle.*

Sir Benj. Brodie performed numerous experiments on animals with arsenic, and in doing so, either applied it to a wound or injected it into the stomach. The results were similar in all essential circumstances. The symptoms were—1. Paralysis of the hind legs, and afterwards of the other parts of the body; convulsions, dilatation of the pupils of the eyes, and insensibility. 2. A feeble, slow, and intermitting pulse. 3. Pain in the region of the abdomen; preternatural secretion of mucus from the alimentary canal, and sickness and vomiting in those animals which are capable of vomiting. These three classes of symptoms respectfully indicate disorder of the heart, brain,

* Review of Jaeger's Inaug. Dissertation, *De Effectibus Arsenici in Varios Organismos*, etc., in *Edinburgh Medical and Surgical Journal*, vol. vii. pp. 80 to 84.

and alimentary canal. Mr. Brodie also found that the symptoms occurred sooner when the arsenic was applied to a wound than when it is given internally.

In whatever way the poison is administered, the inflammation is confined to the stomach and intestines. He never observed any appearance of it in the pharynx or œsophagus.* This inflammation took place more readily indeed from the external application of the poison, than from its administration internally, and it preceded any appearance of inflammation of the wound. The degree of inflammation varied. In some it was very slight, in others considerable, and it appears to be greater or less, according to the time which elapses before the animal dies. The mucous membrane of the stomach and intestines assumes a florid-red color, becomes soft and pulpy, and is separable without much difficulty from the cellular coat, which has its natural appearance. In some instances there are small spots of extravasated blood on the inner surface of the mucous membrane, or between it and the cellular coat, and this occurs independently of vomiting. Mr. Brodie never found ulceration or sloughing of the stomach or intestines, but he suggests that if the animal survives for a length of time after the inflammation has begun, it is reasonable to conclude that it may terminate in one or other of these ways; and it is important not to mistake the layers of coagulated blood for sloughs.†

I may also mention the result of a number of experiments made by Dr. Duncan, Jr., and Dr. Campbell. They are summed up by the former as follows: "1. Arsenic does not act chemically on animal matter, living or dead. 2. Its chief effects are to produce a disease somewhat analogous to cholera morbus,

* Dr. Campbell, however, in several experiments with the white oxide, externally applied, found the œsophagus greatly inflamed. This appearance was witnessed by Dr. Gordon. (Gordon, p. 20.) Orfila mentions it as a common circumstance in persons dead from poison; and he also quotes a case in which it was distinctly observed. (Orfila's Toxicology, vol. i. p. 140.)

† Edinburgh Medical and Surgical Journal, vol. viii. p. 459, from Philosophical Transactions. From his experiments, Mr. Brodie draws the conclusion that arsenic does not produce its deleterious effects until it has passed into the circulation.

whether it be taken directly into the stomach itself, or inserted into the subcutaneous cellular membrane of a remote part, or applied to a delicate membrane. In some few cases, where the action of the poison is most intense, death occurs from the sickness or fainting without vomiting or purging. 3. Frequently a considerable interval intervenes between its being received, even in solution, into the stomach, and its action. 4. Neither paralysis of the voluntary muscles, nor convulsions, nor delirium, nor coma, nor disordered respiration or circulation, are ordinary symptoms of the disease produced by arsenic. 5. After death, we were frequently unable to discover any organic lesion, and we generally found that the inflammation was less, in proportion as the arsenic was more speedily fatal."*

Dr. Roupell, in two instances, injected arsenic into the veins of dogs. In the first, death followed in an hour. The mucous membrane of the small intestines was highly inflamed, and the stomach exhibited the hour-glass contraction, and contained about an ounce of tough mucus. In the other, where death ensued in three hours, the stomach and intestines, to the extremity of the rectum, were highly inflamed, but in neither case was there any appearance of inflammation in the lining membrane of the heart, arteries, or veins.†

When arsenic was *introduced, after death*, into the rectum of animals, and allowed to remain there for twenty-four hours, the mucous membrane in contact with it became of a lively-red color, with darker interspersed patches, as if from extravasation. The other coats were natural, and even the mucous was so, unless the poison actually touched it. The margin of the coloration was abrupt and well defined. When the arsenic was not introduced until twenty-four hours after death, the part to which it was applied presented dark patches, while the rest of

* Edinburgh Medical and Surgical Journal, vol. xi. p. 127. In a recent examination at Paris, of seven horses poisoned by the arseniate of potash, inflammation of the stomach, intestines, and bladder was seen either separately or conjointly, and in all of them there were numerous ecchymoses at the base of the left ventricle of the heart. Every other part of that organ was healthy. (*Annales d'Hygiène*, vol. xii. p. 404.)

† Report of the Fifth Meeting of the British Association for the Advancement of Science, p. 236.

the membrane was healthy. The result of the application of arsenic during life was, on the contrary, a redness which extended to some distance from the points with which the poison had been in contact, and then passed gradually into the healthy color of the surrounding membrane.*

Chemical proofs. The tests of arsenic have been the subject of extensive and animated discussion. I should occupy a large portion of this volume were I to enter into a critical examination of them; and the result, after all, might be to perplex the learner. I prefer, therefore, to point out and dwell on the more important, designate others of inferior value, and make full references to authorities for the student.

Arsenious acid is met with in two forms: as a snow-white powder, and in solid masses, generally opaque, and sometimes translucent. When newly sublimed, it is almost transparent, and has a vitreous lustre. The change to opacity occurs from keeping it, and this hence is possibly owing to the action of the atmosphere.† Guibourt has found the opaque variety most soluble in water. The powder is obtained by grinding down the massy arsenic.‡

Specific gravity. Authors do not exactly agree on this. Dr. Ure says it is 3.729. Transparent varieties, according to Guibourt, have a specific gravity of 3.7385; and the opaque, 3.695. Dr. John K. Mitchell and Mr. Durand, of Philadelphia, found that specimens of the transparent vary from 3.208 to 3.338, while the opaque was 3.656.§ Mr. Alfred S. Taylor found that a mass kept four years, and perfectly opaque, had a specific gravity of 3.529, while that of a recently prepared specimen, perfectly transparent, was 3.798.||

* Orfila's Toxicology, vol. ii. p. 540.

† Kruger imagines that a hydrate is formed. (Brande's Journal, N. S., vol. iv. p. 214.) This is, however, doubted by Berzelius, as no appreciable difference in weight can be discovered.

‡ Bussy, on the other hand, declares that the vitreous is more soluble than the opaque. He grants, however, that there is frequently a mixture of both in various parcels, and that the one may be converted into the other by the action of water at different temperatures. (Comptes Rendus, May and August, 1847.)

§ Philadelphia Journal of Pharmacy, vol. iv. p. 108.

|| Guy's Hospital Reports, vol. ii. p. 91.

Solubility. On this there is still greater diversity of statement. According to Bergman, 80 parts of water at 60° Fahr. dissolve one part of arsenic, while the same is dissolved by 15 parts of boiling water. Navier asserts that 80 parts of boiling water are requisite to dissolve one part. Klaproth, from a series of experiments, found that 400 parts of cold water at 60° dissolve one part, while 13 parts of boiling water were sufficient for the same purpose. He also examined how much of the oxide would be retained by the boiling water after it was cold, and found that 100 parts retained three of the oxide, and the remainder separated in the form of tetrahedral crystals.* Guibourt has found that 1000 parts of temperate water dissolve, in thirty-six hours, 9.6 of the transparent, and 12.5 of the opake variety; and the same quantity of boiling water dissolves, of the transparent, 97 parts, retaining 18 when cooled; but of the opake, takes up 115, and retains on cooling 29.† Hahnemann remarked that at the temperature of the blood, 1000 parts dissolve ten parts, with the aid of ten minutes' agitation.‡ On comparing the results given by various experimentalists, Mr. Taylor found them to differ in the following manner: 1000 parts of temperate water dissolve of their weight of arsenious acid, according to Despretz, one-twentieth; and according to Fischer, one-twelve-hundredth. These are the extremes. Again, 1000 parts of boiling water dissolve one-eighth of their weight, according to Guibourt, and $\frac{1}{20}$ th, according to Nasse. These also are the extremes, but the majority of the experimenters do not go higher than $\frac{1}{24}$ th. A series of experiments were instituted by Mr. Taylor, and from them he arrives at the following conclusions: 1. That hot water allowed to cool from 212° , on this poison dissolves less than $\frac{1}{40}$ th of its weight, or about $1\frac{1}{4}$ grains to each ounce of water. 2. That water boiled for an hour on this substance, dissolves $\frac{1}{24}$ th of its weight, or rather more than 20 grains to each ounce, and this water on perfect cooling, does not retain

* *Annals of Philosophy*, vol. iv. p. 132.

† Guibourt, *Edinburgh New Philosophical Journal*, vol. i. p. 318, from *Journal de Chimie Médicale*.

‡ Christison, p. 228.

more than about $\frac{1}{40}$ th of its weight, or 12 grains to the ounce. 3. That water boiled on arsenious acid to the most perfect state of saturation, after having stood six months, holds dissolved about $\frac{1}{35}$ th of its weight, or 13 grains to the ounce. 4. That water at ordinary temperatures will dissolve from about $\frac{1}{1000}$ th to $\frac{1}{500}$ th of its weight, or from $\frac{1}{2}$ grain to 1 grain to each ounce of solvent, according to circumstances.

The solubility of arsenic is much impaired by the presence of organic principles, as milk or mucus in the water. Hot tea and cold porter will not, according to Mr. Taylor,* take up more than about half a grain to the ounce, while hot coffee and cold brandy do not dissolve more than a grain. These results readily explain the fact why the poison is so often found in the solid state in the stomach.†

The deduction from the above statement is an important one to the medical jurist. It shows the necessity of diluting the suspected substance considerably with water, and also of boiling the fluid for at least two or three hours.

Taste. The common statement in most systematic works is, that it is acrid. Dr. Christison, from experiment, is of opinion that it has scarcely any taste at all, but probably, if any, is rather sweetish. Certainly it has been swallowed, with many articles of food, without the individual being aware of any acidity. The mistake on this point may have arisen from

* Guy's Hospital Reports, vol. ii. p. 102. I have omitted one of Mr. Taylor's conclusions, viz., that there is no observable difference in the solubility of the *transparent* and *opaque* varieties of arsenious acid, because it does not seem to be confirmed by his experiments, although the difference is certainly less than in Guibourt's. In a medico-legal point of view, however, the question, as Mr. Taylor remarks, is not of much importance, since the *transparent* variety is rarely sold by the druggists.

Boutigny and Baudry suspended in river water a piece of opaque arsenic weighing 0.728 grammes. On the fourth day, and not before, sulphuretted hydrogen indicated the presence of arsenic in the water. On the tenth day the arsenic was removed, carefully dried, and weighed. It had lost 0.016 grammes. (*Annales d'Hygiène*, vol. xvii. p. 354.)

† [The question of practicability of administering a large amount of the poison in a state of suspension was thoroughly discussed in the case of Madeleine Smith, tried for the murder of L'Angelier; also in a case investigated by Dr. Christison, *Edinburgh Med. Journal*, December, 1857, p. 481; and *Pharm. Journal*, January, 1858, p. 382.]

confounding the inflammation subsequently induced in the throat, with the impression in the act of swallowing.*

Effect of heat. The oxide of arsenic is sublimed at 380° F., and condenses in the form of a crystalline powder.† If the operation be performed slowly, and on small quantities, the crystals are octahedral. When mixed with charcoal, and heated, it is reduced and the metal sublimed. Berzelius says that it begins to sublime at nascent red heat.‡ Dr. Mitchell, on the other hand, found the temperature required was a *red heat, visible in the dark*.§

Tests of the oxide of arsenic in the solid state.

(a.) The process of REDUCTION is here to be employed. The only instrument necessary is a glass tube; and the best form of it, when the quantity of arsenic is small and probably impure, is that recommended by Berzelius, and now in common use.

Its length should be about three inches, and its diameter, according to Berzelius, should not be more than from $\frac{1}{4}$ th to $\frac{1}{6}$ th of an inch. The matter employed should not fill above three-fourths of an inch.

The arsenic should be mixed with about three times its weight of freshly ignited charcoal. This is decidedly preferable to the black flux which was formerly employed.¶ If the suspected substance be large in quantity, it may be mixed with the charcoal before it is introduced into the tube; but if small, it may be better to drop it into the tube and then cover it over

* Christison, p. 227. Dr. Gordon, in his Inaugural Dissertation, p. 9, says that it is sweet. Hahnemann is of the same opinion, according to Dr. Christison. For authorities and facts in confirmation of Dr. Christison's opinion, see his communication in the Edinburgh Medical and Surgical Journal, vol. xxviii. p. 96; vol. xxxiii. p. 70. (Turner's Chemistry, p. 562, 5th edition.)

† Christison. Thomson says 383° ; Bergman, 388° .

‡ Chimie, vol. ii. p. 429.

§ American Journal of Medical Sciences, vol. x. p. 122.

¶ "The *black flux* may be said to consist of charcoal in a state of extremely minute division and the subcarbonate of potash. It is prepared by deflagrating in a crucible two parts of supertartrate of potash with one part of nitrate of potash." (R. Phillips, Annals, N. S., vol. vii. p. 35.)

with charcoal. For the purpose of introduction, a small glass funnel is the best; and to it may be previously fitted a brass or silver wire, for pushing down the matter that adheres. It is of importance that the materials to be tested should all be collected together, and this object is best effected by the use of the funnel. In order to prevent the consequences of expansion, they should not be too closely rammed together.

Heat is best applied with the spirit-lamp.* The upper part of the material, or the charcoal, should be first heated with a small flame. Then apply the heat to the bottom of the tube with an enlarged flame, and any water that may form on its sides should be removed with a roll of filtering paper. By continuing the tube in the flame, the metallic crust characteristic of arsenic will soon be formed. "The surface next the tube is almost exactly like polished steel, being a little darker in color, but equal in brilliancy and polish, and the inner surface is either brilliantly crystalline to the naked eye, like the fracture of cast iron, or has a dull grayish-white color, but appears crystalline before a common magnifying lens of four or five powers."†

These properties are manifest even in the most minute quantities. Berzelius says that 190th of a grain of the oxide is more than sufficient to form a good crust.‡

* Mr. Phillips and Mr. Brande appear each to have recommended this; but the first more particularly called the attention of chemists to it. (Annals, N. S., vol. vii. p. 36; vol. x. p. 300.)

The *oxalate of soda* has been recommended by Mr. McGregor as preferable to the black flux, in reducing arsenious acid or the sulphuret. One part of arsenic is to be added to three parts of oxalate. (London Med. Gazette, vol. xxii. p. 614.) While Gobel has found the allied salt of *formate of soda* equally efficacious in the reduction. The substance to be examined, whether oxide or sulphuret, is mixed with the formate, and heated in the usual manner, in a small glass tube, over the flame of a lamp. The arsenic sublimes. (London and Edinburgh Phil. Magazine, vol. xiii. p. 394.)

† Christison, p. 225. For Berzelius' directions, see his Chemistry, or Annals, N. S., vol. xi. p. 232.

‡ Rose detected one-eighth of a grain, although it was mixed with animal matter. (Edinburgh Medical and Surgical Journal, vol. vii. p. 85.) The late Professor Gorham, of Harvard University, also produced a distinct metallic film from the same quantity. (New England Journal, vol. vi. p. 228.) Dr. Traill, one-tenth of a grain. (Annals, N. S., vol. vii. p. 131.) Dr. Christison,

It has been objected to this test, that other substances, when treated in the same manner, may put on a similar appearance. Dr. Paris states that a film of very finely divided charcoal has thus been mistaken for arsenic.* Antimony, when reduced, is also said to resemble the crust. This, however, is totally denied by Dr. Christison. And recently, Dr. Mitchell, of Philadelphia, has observed that cinnabar mixed with carbon, and heated, exactly counterfeits metallic arsenic in its appearance.†

If the glass tube contains lead, it may assume an appearance on the outside resembling that of reduced arsenic. This is mentioned by Mr. Donovan, and I have repeatedly witnessed it when the heat was driven high.‡

It is from circumstances like these, although I was aware of but a portion of them, and particularly from an unwillingness to recommend any particular test to *the exclusion of all others*, that I was induced to make the remarks in the previous edition on the reduction test. The dispute, if there be any, is after all, I apprehend, more in words than in fact. No one conversant with the subject will deny that reduction is the *confirmatory, the decisive proof*; but I also presume that no medical jurist, with the reduced metal before him, would be willing to stop with that experiment, and go into court and testify to the existence of arsenic. Certainly he would omit some of the means of rendering *assurance doubly sure*.§

(b.) *Oxidation of the metallic arsenic by heat.* Apply heat to the ball which now contains the flux deprived of arsenic, and attach a bit of glass tube to its end, so that it can be drawn off

one-sixteenth, one-hundredth part of a grain, and even less. (Edinburgh Medical and Surgical Journal, vol. xxii. p. 82; vol. xxxiii. p. 68. Edinburgh Medico-Chirurgical Transactions, vol. ii. p. 93.)

* Pharmacologia, p. 217.

† American Journal of Medical Sciences, vol. x. p. 126.

‡ Not long since it was hinted that if arsenic had been used in the manufacture of glass, that metal might be reduced by a high heat, and thus impair the correctness of any medico-legal experiment. This, however, has been shown to be a perfectly futile objection, by Chevallier, (Annales d'Hygiène, vol. xi. p. 224; Baltimore Medical and Surgical Journal, vol. i. p. 513; and by Ozanam, Edinburgh Med. and Surgical Journal, vol. xlviii. p. 440.) See also Orfila, Annales d'Hygiène, vol. xxiii. p. 430.

§ See, on this point, a note by Devergie, Médecine Legale, vol. ii. p. 437.

and leave the crust free of any danger of contact with it. Then apply heat to the crust with the spirit-lamp, till it is all converted into a white powder. This (the arsenious acid) will then crystallize in the form of octahedrons, which can be readily seen with a proper lens.

A necessary caution in performing this experiment is, not to heat the tube too suddenly or too highly, or the oxide may otherwise unite with the glass and form a white opaque enamel. It is better to pass the tube repeatedly through the flame till the object is effected.

(c.) A portion of the tube containing the oxide may now be filed off. Boil this in a draehm or two of distilled water, acidulate the solution in the manner hereafter directed, and apply the liquid tests to be presently described.*

(d.) Dr. Christison recommends, as an additional test for the oxide in its solid state, to keep it for a few hours in a solution of the ammoniacal sulphate of copper.† It will be gradually converted into an apple-green powder, forming the arsenite of copper, while the blue solution of the cupreous salt becomes colorless. "No other substance in nature," he adds, "exhibits the same phenomenon with this agent."‡

The remaining tests are mentioned from having found a place in every work on medical jurisprudence. They are equivocal, besides requiring such a portion of arsenic as can hardly be spared in most cases.

(e.) *The garlic smell.* If a portion of arsenic be thrown on red-hot iron or burning charcoal, it will evaporate with a white smoke, and a peculiar smell like garlic. Phosphorus, however,

* Christison, p. 236. Clark, in Brande's Journal, N. S., vol. vi. p. 357. Orfila has shown that *metallic arsenic*, when boiled with distilled water for two hours, is so far converted into arsenious acid as to permit the liquid tests to operate. (Annales d'Hygiène, vol. ii. p. 484.)

† This appears to have been suggested by Orfila. (Edinburgh Med. and Surg. Journal, vol. xxii. p. 81.)

‡ Mr. Smithson also proposed to ascertain the presence of solid arsenic by fusing it with nitrate of potash. Arseniate of potash is the product which gives a brick-red precipitate with nitrate of silver. (Annals of Philosophy, N. S., vol. iv. p. 127.) A mode of applying this to a solution of arsenic is given by Mr. R. Phillips, in *ibid.*, vol. vii. p. 35.

and zinc, under the same circumstances, burn with a similar odor.* Animal matter, and even paper will also sometimes imitate it.†

On the other hand, if arsenic be mixed with either a vegetable or animal substance, the smoke and smell arising from these bodies, when heated, will altogether prevent us from detecting the peculiar properties of the arsenic. Dr. Bostock mixed equal parts of arsenic and flour, and placed them on iron at a low red heat, but the suffocating smoke arising from the flour alone could be perceived.‡

It is also ascertained that the garlic odor is evolved by the sublimation of metallic arsenic only, and not by the oxide, unless it be at the same time reduced.§ Thus, Dr. Paris found that when the oxide was projected on red-hot copper or iron, the garlic smell was produced, but when it was placed on a plate of copper, iron, or platina, and heat was applied by the spirit-lamp or the blow-pipe, no odor was perceptible. No reduction took place in this case, and the arsenious acid was dissipated before the copper could acquire a degree of temperature sufficient to deoxidize it.

(f.) *The tombac or silvery alloy.* This is produced by mixing the oxide with charcoal, or the black flux, and placing it between two copper plates, which are bound together by iron wire, and then subjecting it to heat for a few minutes. On rubbing the plates, a silvery white stain will be left on the surface of the copper, which is an alloy of the two metals. This, also, is an uncertain test. Dr. Bostock placed charcoal alone, moistened with oil, between copper plates, and after applying heat in the manner just directed, found an appearance somewhat similar to the alloy.|| Dr. McNevin ascertained that

* Edinburgh Medical and Surgical Journal, vol. vii. p. 85; Murray's Chemistry, vol. iii. p. 358.

† Christison, p. 237.

‡ Edinburgh Medical and Surgical Journal, vol. vii. p. 173.

§ Paris, in Brande's Journal, vol. vi. p. 342. R. Phillips, in Annals, N. S., vol. ii. p. 227. Orfila claims the discovery of these facts for Berzelius. (Leçons, 3d ed., vol. iii. p. 144.)

|| Edinburgh Medical and Surgical Journal, vol. v. p. 172. On this test, see Orfila, (American Journal of Medical Sciences, vol. v. p. 233;) Brugnatelli. (Philosophical Magazine, vol. xliii. p. 445.)

oxide of tin had nearly the same effect on copper as oxide of arsenic has. If the quantity used be sufficient, it is probable that no mistake could be made in confounding the respective states of the copper; but, as I have already remarked, we can seldom spare enough for this purpose, and the use of this test must therefore be discouraged.*

Tests of oxide of arsenic in solution.

(a.) *Sulphuretted hydrogen.* If the fluid to be tested is alkaline, this gas will not act, because the precipitate it would otherwise form is soluble in the alkalies. If, on the other hand, a mineral acid be present in excess, an excess of sulphur is thrown down. This will defeat any subsequent attempts at reduction. Hence, if the suspected fluid reddens litmus, it must be neutralized with potash; if it be alkaline, it must be acidulated with acetic acid. This last, indeed, is now recommended to be used in all cases, as sulphuretted hydrogen has no action on acetic acid.†

* Besides the modes of reduction mentioned in the text, I may state two others. One is recommended by Dr. A. T. Thompson. It is to boil the suspected fluid with animal charcoal. The arsenic will be absorbed by it, and after removing the fluid, it may be reduced and sublimed by drying and heating the charcoal. This process, however, will not answer when the quantity of oxide is small. The other is the application of galvanism. This was first suggested by Jaeger, and several German chemists have used it with various modifications of apparatus; but it also, from their own confessions, is not delicate. (Edinburgh Medical and Surgical Journal, vol. vii. p. 85; Orfila's Toxicology, vol. i. p. 108; Christison, p. 249.)

Dr. Clendenning has recommended the following method, founded on the researches of Mr. E. Davy: "A portion of the arsenical substance is mixed in a platina crucible, with a little muriatic acid. A piece of zinc-foil or wire is then dipped into the mixture and stirred about gently on the bottom for one or two minutes, when the platina will be found more or less covered with a crust of metallic arsenic. On throwing away the acid fluid, and applying heat to the platina, the arsenic rose in alliaceous vapors; it also gave the arsenites of silver and copper with the tests. In this manner Dr. Clendenning successfully operated on arsenic mixed with milk, soup, coffee, tea, etc. (London Medical Gazette, vol. xii. p. 440.) For Mr. Davy's paper, see Philosophical Magazine and Annals, vol. ix. p. 38.

† "When sulphuretted hydrogen is applied alone to a solution of arsenious acid, a reddish-yellow color is produced, *without any precipitate*, but if a few

With this previous preparation of the fluid, it is to be subjected to a stream of sulphuretted hydrogen gas for ten or fifteen minutes.* The first portions of the gas turn the arsenical solution to a bright lemon-yellow color, and the subsequent portions throw down a flocculent precipitate of a sulphur-yellow tint, which is the sulphuret of arsenic. If the proportion of oxide in solution be small, there will be only a yellowness, owing to the sulphuret being soluble in an excess of sulphuretted hydrogen. This excess may be expelled by boiling, after which a distinct precipitate is obtained.

[The characters which determine this sulphuret of arsenic are—1. It is insoluble in water, alcohol, or acids. 2. It is promptly dissolved by caustic potassa, soda, or ammonia. 3. When dried and heated with three parts of dry carbonate of soda and one part of cyanide of potassium, it sublimes metallic arsenic.]

The following are the only substances that can be confounded with the sulphuret of arsenic: The salts of cadmium yield nearly the same color, but they are very rare.† The precipitated sulphuret of cadmium also is not soluble in ammonia.‡ The salts of selenium also give a yellow precipitate, but these are also very rare. The persalts of tin give a dirty grayish-yellow precipitate, but ammonia turns it brown. The salts of antimony form an orange red precipitate, with sulphuretted hydrogen.

drops of hydrochloric acid be added to the mixture, a yellow precipitate instantly falls down." Boutigny has ascertained that several other acids produce the same effect, and he is disposed to ascribe the above action to electrical influence. (Devergie, vol. ii. p. 716.)

* Mr. Griffin, author of *Chemical Recreations*, advises the following, as an easy method of applying sulphuretted hydrogen: "Take a test tube an inch wide and six inches long; put into it half a grain of sulphuret of antimony or iron, and two or three drops of muriatic acid; insert into the mouth of the tube a slip of white paper three inches long and half an inch wide, wetted with the solution under examination, previously acidified; allow a portion of the paper to project beyond; apply heat with a spirit-lamp, etc." (London and Edinburgh Phil. Mag., vol. xiii. p. 204.)

† It was, in fact, this very property of yielding a yellow precipitate, with sulphuretted hydrogen, that led to the discovery of cadmium by Stromeyer. (Thomson's *History of Chemistry*, vol. ii. p. 220.)

‡ Bischoff, *Philosophical Magazine and Annals*, vol. ii. p. 231.

This is a very minute test. Children found a decided yellow color in an ounce of distilled water to which one drop of arsenious acid had been added. Jaeger detected arsenic thus in a solution which bore the proportion to the water of one to 50,000; and Christison says that it acts on the oxide in a hundred thousand parts of water.*

Sulphuretted hydrogen gas should, in all cases, be used in preference to its solution, or to the hydrosulphate of ammonia. The ammonia of the latter may keep the arsenical sulphuret in solution.†

(b.) *Ammoniacal nitrate of silver.* Dissolve lunar caustic in ten parts of water; add ammonia, which will precipitate the oxide of silver, and then redissolve the precipitate nearly, but not entirely, by adding gradually an excess of ammonia. In this state the ammoniacal nitrate of silver will cause, even in a weak solution of oxide of arsenic, a lively lemon-yellow precipitate, the arsenite of silver, which passes to a dark brown under exposure to light.

There are, however, many impediments to perfect action of this test. Several of the acids, as well as an excess of ammonia, prevent its due operation. Common salt, if present, will give a pale yellowish-white color to the arsenical precipitate. Dr. Forbes, of Aberdeen, proposes to remove this difficulty by using the nitrate of silver alone, as long as any white precipitate falls down, then add a slight excess of it, and after subsidence, to drop in ammonia. The chloride of sodium is thus removed and the yellow arsenite of silver is formed in the last part of the process.‡

The following method, proposed and used by Professor Traill, is probably the best yet suggested for showing the minuteness of this test: He places a drop of the suspected liquid on a

* Annals, N. S., vol. i. p. 143; Edinburgh Medical and Surgical Journal, vol. vii. p. 65; Christison, p. 242.

† The uncertainty attending this last may be seen in Dr. Bostock's paper. (Edinburgh Medical and Surgical Journal, vol. v. p. 167; Orfila's Toxicology, vol. i. p. 104.) The smallest addition of ammonia, when sulphuretted hydrogen alone has been used, and the fluid is yellow, will instantly render it colorless. (Ibid., Leçons, 3d ed., vol. iii. p. 148.)

‡ Edinburgh Med. and Surg. Journal, vol. xxxiii. p. 335.

plate of clear glass, and near it another of the ammoniaco-nitrate. Then join them by means of a glass rod, without completely mingling. With one-thousandth of a grain dissolved in water by boiling, the test gave a rich yellow flaky precipitate, which, on subsidence, left the liquid clear. With $\frac{1}{4000}$ th of a grain the character of the precipitate was still distinctly seen by the naked eye, and even with $\frac{1}{12000}$ th of a grain, a lens of moderate power enabled Dr. Traill to observe the yellow flakes in a clear liquid. In all these experiments, he adds, it aids the eye much to place the plate on some dark ground, such as the sleeve of a coat.*

But this test cannot be depended upon for exhibiting its characteristic appearance, if vegetable or animal matter is present. It is useful, however, even there, as its precipitate is copious, and which may be employed in any additional experiments.†

(c.) *The ammoniacal sulphate of copper* is prepared by the same process as the last test; sulphate of copper being substituted for nitrate of silver. It causes in solutions of oxide of arsenic an apple-green or grass-green precipitate. Arsenite of copper is formed.

This is also a delicate test; but its operation is prevented by the presence of ammonia and several of the acids. So also vegetable infusions and animal fluids prevent its characteristic

* Edinburgh Med. and Surg. Journal, vol. l. p. 171. Dr. Traill states that the precipitate cannot be confounded with the phosphate of silver, "for none of the phosphoric salts afford precipitates with the ammoniaco-nitrate of silver, though they do with the nitrate."

† This test was originally proposed by Mr. Joseph Hume, modified by Dr. Marcet, and finally presented in its present form by the original proposer. Its history, and discussions concerning its value, may be found in Philosophical Magazine, vol. xxxiii. p. 401; vol. xl. pp. 105, 179, 296, 333, 431; vol. li. p. 149.

Medico-Chirurgical Transactions, vol. ii. p. 157; vol. iii. p. 342; vol. vi. p. 663, papers of Drs. Marcet and Roget.

Edinburgh Medical and Surgical Journal, vol. xxii. p. 64.

Annals of Philosophy, vol. viii. p. 152; *ibid.*, N. S., vol. i. p. 142; vol. vii. p. 33; Mr. Richard Phillips. *Ibid.*, N. S., vol. x. p. 60; Dr. Paris.

London Med. Repository, vol. viii. p. 178; Dr. Thomson.

color; and again, a green color is produced by its action on different substances when arsenic is not present.*

(d.) *Reduction of sulphuret of arsenic, as obtained by process (a.)* After the precipitate has been allowed to subside, and the supernatant fluid has been removed by the pipette, the remainder is poured on a filter. Allow a sufficient time for draining off the fluid, and the filter is then greatly compressed between the folds of bibulous paper, and the sulphuret removed with the point of a knife before it dries. The drying may be done on a watch-glass in a vapor bath or in a tube. The object in either case is not only this, but also to drive off any excess of sulphuretted hydrogen that may be present. If a tube has been employed, the bottom of it which contains the precipitate may be cut off with a file.

It is now to be covered with a flux consisting of an alkaline carbonate and charcoal, either the black flux, or a mixture of two parts of ignited carbonate of soda and one of charcoal. Mr. Taylor advises as the best proportions, four parts by weight of the black flux to one of the sulphuret. Heat must first be applied to the part containing the flux, and the continuance of its application (which requires longer time than with arsenious acid) reduced the metal.†

(e) *Arseniuretted hydrogen test.* We are indebted for this

* On this test, see Dr. Bostock, *Edinburgh Med. and Surg. Journal*, vol. v. p. 169; *Paris' Pharmacologia and Med. Jurisprudence*.

Edinburgh Med. and Surgical Journal, vol. xiii. p. 519; vol. xxi. p. 427.

Annals of Philosophy, N. S., vol. vii. p. 33.

Braconnot on the Schweinfurt green, *Edinburgh Journal of Science*, vol. x. p. 358.

On the liquid test generally, see Dr. Murray, *Edinburgh Med. and Surg. Journal*, vol. xli. p. 365. He proposes to apply them for testing solid arsenic; and in *ibid.*, vol. xlii. p. 86, to its detection in mixed fluids.

Dr. Brown on the tests of arsenious acid, *United States Medical and Surgical Journal*, vol. i. p. 11.

† Berzelius has also recommended the following: After a portion of the sulphuret has been introduced into the tube, insert a piece of steel piano-forte wire an inch long, so as to reach the surface of the sulphuret. Heat the wire with a spirit-lamp, and continue it until the sulphuret, in a state of vapor, passes along the heated iron. In this way sulphuret of iron and metallic arsenic are obtained. The operation should be conducted slowly. (*Edinburgh New Philosophical Journal*, vol. ii. p. 338.)

minute test to Mr. Marsh, of Woolwich. In return for his communication of it to the Society of Arts in London, he received their large gold medal. The principle of it is to generate hydrogen slowly in the midst of a liquid containing arsenious or arsenic acid, or any of their soluble salts. For this purpose Mr. Marsh devised the following apparatus: A glass tube, open at both ends, and about three-quarters of an inch in its internal diameter, is bent in the form of a syphon, the shorter leg being about five inches, and the longer about eight inches in length. A stop-cock, furnished with a jet of fine bore, is fitted to the shorter leg, and the whole apparatus is secured in an upright position by attaching it to a wooden block and pillar with slips of India-rubber. The suspected liquid, after being freed from bulky organic matters in the manner to be hereafter described, is mixed with a portion of diluted sulphuric acid, (from a drachm and a half to three drachms is recommended by Mr. Marsh,) and then introduced into the longer leg of the tube. A piece of metallic zinc is now dropped into the shorter leg, and the stop-cock is properly adjusted. Hydrogen will of course be evolved, if the liquid be pure, but if it contains arsenic, the product will be arseniuretted hydrogen. After allowing the first portions to escape, a lighted taper is to be applied, when, if it be the poison, it will burn with a dull white flame. If a plate of clean glass be brought over the flame, a circular stain of metallic arsenic is formed upon it, while the combustion of the hydrogen at the same time produces a ring of aqueous vapor around the metallic stain. If a glass tube be held at an angle of forty-five degrees over the jet of flame, it will become lined with metallic arsenic at the part nearest where the flame impinges, and with white arsenic or arsenious acid at a short distance from it.

The testimony in favor of the test is of the highest character. Mr. Marsh himself obtained distinct metallic crusts when operating on only one drop of Fowler's solution, which contains the one hundred and twentieth part of a grain. Mr. Pereira detected the poison in a liquid which gave no indication with the silver and copper tests, although it did with sulphuretted hydrogen. Mr. Herepath pronounces this test the

most elegant that can be conceived, and at the same time the most sensitive. He commends, however, that instead of a plate of glass one of mica should be used, with three drops of water in separate places on its surface. If the flame be allowed to play under one of these, the evaporation of the water kept the place cool and increased the thickness of the crust, while the danger of fracture was avoided. On inverting the plate and holding the drops some little height above the flame, they become solutions of arsenious acid, and can be tested accordingly. Mr. Taylor has found this test effectual in cases where sulphuretted hydrogen gave no indication, and he obtained sublimates from the hundredth part of a grain diffused in 45,000 of water. M. Liebig and Mohr confirm these results in their fullest extent. Indeed, the former remarks that the sensibility of Mr. Marsh's method almost surpasses imagination. Mr. Mohr advises the use of porcelain, in place of glass or mica, when we wish to detect very delicate shades.*

Berzelius, while he highly commends the method of Mr. Marsh, observes that the inventor has neglected a property of this gas which may be applied most satisfactorily in such investigations, viz., that of depositing the arsenic by heat. It is only necessary to pass the gas through a tube heated to redness in one part; the arseniuretted hydrogen is then decomposed into arsenic, which is deposited farther in a cool part of the tube, and into hydrogen, which is disengaged in a pure state. The only apparatus needed for this purpose, he adds, is a flask for the disengagement of the gas, and a pipe to conduct it, as soon as disengaged, through a glass tube heated to redness in one part by the flame of a spirit-lamp. "If we wish, for greater certainty, to place in the red part of the tube a small quantity of a known weight of copper reduced by hydrogen, a white arseniuret of copper will be obtained, and we may thence ascertain with great exactness

* London Med. Gazette, vol. xviii. p. 650, containing Mr. Marsh's paper. Pereira, London Med. Gazette, vol. xviii. p. 164. Herepath, Proceedings of British Association for 1836, Appendix, p. 69. Taylor, Guy's Hospital Reports, vol. ii. p. 76. Mohr and Liebig, in Journal de Pharmacie, vol. xxiii. p. 562, translated in American Journal of Pharmacy, vol. x. p. 58.

the weight of the arsenic which accompanies the hydrogen." Berzelius detected by this process the presence of a milligramme of arsenic, which had been previously dissolved in sulphuric acid and then operated on in the manner proposed by himself and Mr. Marsh.*

Several objections have been made against this test. One was anticipated by the inventor, viz., that the zinc used may contain arsenic, and so also may the sulphuric acid. But the difficulty in either case is obviated by first trying the purity of the materials. Perform the experiment with zinc and diluted sulphuric acid alone, and if arsenic be present in them, its characteristic stain will be exhibited.† Another has been stated by Mr. Lewis Thompson. It is that an alloy of antimony and zinc, when acted on by sulphuric acid, will produce an inflammable gas (called by Mr. Thompson *antimoniuretted hydrogen*) which burns with a pale bluish-green flame resembling that of arseniuretted hydrogen, and when a piece of cold glass or china is held in the flame, a metallic crust is deposited, while with a glass tube there is a metallic film in the part nearest the flame and a white oxide beyond it. Again, if sulphuretted hydrogen be passed over the oxides of these metals, particularly if their quantity be minute, the color of the product may not be strikingly different. To obviate these difficulties, and to distinguish between the two metals, the crust should be treated with a drop of nitric acid, which immediately dissolves both. Pass a current of sulphuretted hydrogen over a portion of this, and if it be arsenic, orpiment will be produced soluble in liquid ammonia. Another portion may be evaporated to dryness. The white powder thus produced, is now to be tested with a dilute solution of nitrate of silver, and the whole exposed to the fumes of a stopper moistened with ammonia. If it be antimony, a dense white precipitate will be deposited, while arsenic will exhibit canary-yellow flocculi.‡

* Journal de Pharmacie, vol. xxiv. p. 179.

† Pure hydrogen leaves no stain on the porcelain. See O. Henry, in Journal de pharmacie, vol. xxv. p. 249.

‡ Thompson, London and Edinburgh Philosophical Magazine, vol. x. p. 353. See also Vogel, Journal de Pharmacie, vol. xxiv. p. 125; Fresenius'

Mr. Marsh himself states that, in repeated experiments, he found Hume's test (the ammoniaco-nitrate of silver) extremely useful as a discriminative test for arsenic or antimony. After the matter to be tested has been acted upon by his apparatus, a piece of common window glass, (which he prefers,) porcelain, or mica, is to have one of its surfaces moistened with Hume's test; it is then to be held horizontally, with its moistened side downward, directly over the ignited jet of gas, about half an inch from the tip of the flame. If arsenic be present, the well-known characteristic lemon-yellow color is instantly produced; if antimony be in the mixture, a curdy-white precipitate is obtained; if, on the contrary, neither arsenic nor antimony is in the matter under examination, the hydrogen instantly reduces the silver of the test liquor to the metallic state.*

(a.) *Reinsch's Process.* This method consists in *acidulating the arsenical fluids with muriatic acid, and boiling them with metallic copper, which then becomes covered with a steel-gray crust of metallic arsenic.* I subjoin some of the details of his early experiments:—

A slip of copper immersed in hydrochloric acid, specific gravity 1.172, containing arsenic, was not acted upon in a closed vessel, after remaining twelve hours at the ordinary temperature. But when the acid was diluted with an equal quantity of water, action took place after a few hours, the arsenic being precipitated upon the copper. If the solution was exposed to the air, the action took place in a still shorter time; but if heated, it occurred nearly immediately, whether the acid was concentrated or diluted. The copper was covered at first with a grayish brilliant metallic coating, which, upon increase of temperature, and according to the quantity of

method, in *Journal of the Franklin Institute*, 3d series, vol. v. p. 420; Behrens, *Journal de Pharmacie*, July, 1843; Dr. Brett, *London and Edinburgh Philosophical Magazine*, vol. xx. p. 403; Parnell's *Elements of Chemical Analysis*; Simon, in *American Journal of Pharmacie*, vol. x. p. 217; also Taylor on Poisons, p. 355.

* *London and Edinburgh Philosophical Magazine*, vol. xv. p. 282. This method appears to have been successfully employed in a criminal case in France. (*Journal de Pharmacie*, vol. xxiv. p. 500.)

arsenic present in the solution, turned black, and finally separated in black scales.

In order to ascertain the delicacy of this reaction, a solution of one part of arsenious acid was made in 1000 parts of pure hydrochloric acid diluted with water. A portion of this solution (to which one-third of pure hydrochloric acid was added) containing 1-100,000th part of arsenic was acted upon as soon as it was heated; at first the precipitate had the appearance of iron, but after long boiling it became black, with a metallic lustre. With a solution containing 1-200,000th part, the copper was distinctly covered with arsenic, after a quarter of an hour's boiling.* The limit appears to be between 1-250,000th and 1-300,000th parts, and is, therefore, considered greater than that of any other reagents, and is not likely to be mistaken for other substances.

Copper does not precipitate *antimony* with the same iron-like appearance. The precipitate has a less metallic lustre, and is of a decided violet color. With a solution containing 1-200,000th part of antimony, the precipitation is so thin that the copper shines through, but has still a violet hue. Antimony gives no precipitate without the addition of hydrochloric acid. The difference between the antimonial and arsenical precipitates is very manifest when they are compared together.†

The solution of *bismuth* is immediately precipitated in a crystalline state, while *silver and mercury* are precipitated with a silver lustre, and the reaction does not exceed a 1-20,000th part in solution.‡

The simplicity of this test and its ready execution have made it universally popular. Still it will be very necessary to repeat one or more of the tests already mentioned, on the crust of arsenic that is obtained, and thus prove the nature of the metal.

I will very briefly mention some other tests that have been proposed.

* Taylor limits it to 1-90,000th. (Taylor on Poisons, p. 360.)

† This process is applicable to the separation of arsenic from liquids containing organic matters. (Brit. and For. Med. Rev., July, 1843, p. 281.)

‡ London, Edinburgh, and Dublin Philosophical Magazine, December, 1841.

1. *Lime-water* gives a fine white precipitate with arsenious acid in solution—the arsenite of lime. This is a favorite with the German chemists.* But it acts on numerous other substances in a similar manner, and again it does not act if the solution contains free nitric, muriatic, and acetic acids.

2. *Chromate of potash* has been proposed by Dr. Cooper. It causes, when added to a solution of arsenious acid, a grass-green precipitate in about half an hour. This is the protoxide of chrome.†

3. *Iodine of potassium* has been recommended by Professor Emmet, of the University of Virginia. It gives a white precipitate, which, on the addition of nitric acid, changes to a dark brown, purple, or black, according to the quantity. If starch be added at the same time, the deep-blue tint, indicative of iodine, is present. Muriatic acid turns it to a bright yellow.‡

In applying reagents to suspected solutions, it has been customary to advise the employment of glass tubes. These, however, are now generally superseded by watch-glasses—a plain piece of glass, or what is probably still better, a porcelain tablet. Mr. Herepath thus found the green of Scheele to become more evident, by the contrast of color with the white plate. The ammoniacal nitrate of silver can be used in the same way. The quantity required of the suspected fluid needs thus to be quite small—a consideration frequently of no little importance in medico-legal cases. We may even, as also suggested by Mr. Herepath, employ a piece of white blotting paper, placed on a flat chalk stone, and guide the reagents, by means of a glass rod, to portions of the suspected fluid. These,

* Jaeger speaks of it as a delicate test. (Edinburgh Medical and Surgical Journal, vol. vii. p. 84.) Lime-water also enters into the processes recommended by Rose and Fischer. (Orfila's Toxicology, vol. i. p. 135.)

† Silliman's Journal, vol. iv. p. 159. See also *ibid.*, vol. iii. p. 354. Dr. Silliman (Chemistry, vol. ii. p. 193,) says, "this appears to be one of the best tests that we possess." Dr. Reid, however, mentions (Chemistry, p. 346,) that if a solution of bichromate of potash be added to a solution of tartar emetic, the liquid will assume the same green color as with arsenic. This was pointed out by Mr. Laurence Reid, and the test of course is useless in any case where tartar emetic is supposed to have been used.

‡ Silliman's Journal, vol. xviii. p. 58.

when dried, retain their characteristic appearances, and may be introduced into sealed tubes, for the purpose of exhibition on the trial.*

Tests of oxide of arsenic when mixed with organic fluids and solids, and with the contents and tissues of the stomach.

It is safest, in medico-legal cases, to take the stomach itself, cut it into small shreds, and boil it in distilled water, along with any fluids that may be found in it. This should be continued for half an hour. The coarser solid particles are then separated by a gauze filter, and the fluid is filtered through paper. This filtration occupies at least thirty-six hours. *Preserve the solid residuum remaining on the filter, for future examination, if necessary.*

In order to free the fluid from animal matter, acetic acid should be added. And before applying sulphuretted hydrogen, it may be advisable to use the nitrate of silver as a trial test, in the manner already recommended. For this purpose, neutralize the fluid with ammonia or potash, and test a few drops with ammoniacal nitrate of silver. If it gives its characteristic precipitate, the process may be proceeded with; if not, evaporate the solution, with a moderate heat, to dryness, form a new solution by boiling successive portions of distilled water on the residue, and, when cool, filter this solution.

The remaining steps are similar to those already described; acidulation with acetic acid, precipitation by sulphuretted hydrogen, reduction of the sulphuret, and oxidation of the metal. If the sulphuret, after boiling, does not subside easily, add a little muriate of ammonia: and if the fluid still continues muddy, and the deposition is not complete, allow it to remain at rest for forty-eight hours, or more.†

Marsh and Reinsch's process must, of course, be employed whenever they are applicable.

Besides this process, others have been recommended by various writers: Orfila, at one period, proposed to decolorize

* Proceedings of British Association, 1836, Appendix, p. 68.

† Christison, p. 252.

by chlorine, and supposed that the liquid tests would then act. Mr. Phillips advised to agitate the fluid with animal charcoal. Rose recommended the German process, of forming arsenite of lime, and reducing it with charcoal and boracic acid. Rapp's process consisted in deflagrating the organic matter, and peroxidating the oxide of arsenic, by means of fused nitrate of potash. Dr. Paris has advised that the whole arsenic be thrown down with ammoniated nitrate of silver, and the precipitate reduced in a tube. Berzelius boils the suspected substance in potash, neutralizes the solution with muriatic acid, adds sulphuretted hydrogen, and then boils and evaporates till the precipitate subsides. The precipitate is then collected, dried, mixed with nitre in a large proportion, and deflagrated in a tube. The product is dissolved in an excess of lime-water, and the arseniate of lime so formed is collected and reduced with charcoal.*

The problem of the detection of arsenic in the organs and tissues of the human body has been a subject of great attention of late years. I have in another place given in detail the researches of Orfila and Devergie,† and will only state here, as briefly as possible, the processes that have been recommended:—

* The following authorities may be consulted : On the detection of minute portions of arsenic in mixed fluids, by Prof. Christison. (Edinburgh Medical and Surgical Journal, vol. xxii. p. 60.) An account of several cases of poisoning with arsenic, in illustration of the delicacy of the chemical evidence, etc., by Prof. Christison. (Edinburgh Medico-Chirurgical Transactions, vol. ii. p. 273.) Paris and Fonblanque, vol. ii. p. 252. Thomson's London Dispensatory, p. 177. Berzelius' *Chimie*, vol. ii. p. 447. Berzelius, *Edinburgh Journal of Science*, vol. iv. p. 131. Giseke's account of Rose and Berzelius' process. (Brande's Journal, vol. xx. p. 398.) R. Phillips, *Annals of Philosophy*, N. S., vol. vii. p. 31; vol. x. p. 300. Dr. Christison, *Ibid.*, vol. xii. p. 25. Dr. O'Shaughnessy, *Lancet*, N. S., vol. vii. p. 546. Dr. Venables, *London Medical Gazette*, vol. vi. p. 615; vol. x. p. 115; and *American Journal Med. Sciences*, vol. ix. p. 524. Taufflieb's method of treating mixed fluids with a solution of oxide of zinc in potash. (*Journal de Pharmacie*, vol. xx. p. 392; translated in *Philadelphia Journal of Pharmacy*, vol. vii. p. 71.) Reid's *Chemistry*, p. 347. Hays' *American Cyclopaedia of Medicine and Surgery*, vol. ii. art. *Arsenic*, by Dr. John K. Mitchell. Transactions of the Maryland Academy of Science and Literature, vol. i. art. 7, *On the Detection of Arsenic in Medico-legal Investigations*, by William R. Fisher.

† *American Journal of Medical Sciences*, N. S., vol. ii. p. 403.

Orfila (after rejecting the use of nitre, as formerly proposed by him,) advises that the organs, the liver, spleen, lungs, or any other, or a certain quantity of the blood supposed to be poisoned, be dried thoroughly, and then boiled with pure concentrated nitric acid until carbonization occurs. The charcoal produced is powdered, boiled in water, and may be examined with the tests for arsenic acid.

Dauger and Flandin carbonize the animal matter by boiling it with strong sulphuric acid, and then digesting the residuum with nitro-muriatic acid. Here, also, arsenic acid is produced.

Lastly, Reinsch recommends the boiling of animal matter with diluted muriatic acid, and then pressing out and filtering the fluid produced. To this his peculiar tests may be applied. These are merely the outlines of the various processes that have been suggested, and I refer the reader to the authorities quoted below for further information.*

* Orfila and Devergie's *Memoirs*, in *Annales d'Hygiène*, vols. xxi., xxii., and xxiii. The questions, whether arsenic exists in the healthy human body and in graveyards, are here also discussed. The first may be discredited; the last can only come into discussion when the body has been interred for many years. (Dr. Smith, in *Silliman's Journal*, vol. xl. *British and Foreign Med. Review*, No. 21. London and Edinburgh *Philos. Magazine*, vol. xvi. p. 341. See also Taylor on Poisons, p. 560.)

To these I will add other references bearing on the matters noticed above: Bongean, on the elimination of arsenic from the system. (*Monthly Journal Medical Science*, December, 1845.) Adouard, on the detection in the *fœtus* of poison administered to the mother. (*Comptes Rendus*.) Herepath, on the detection of arsenic in the liver. (*Lancet*, May 27, 1843.) This chemist detected arsenic in the *bones*, after eight years interment. I subjoin a portion of his testimony on the trial for poisoning: "I have never found arsenic in a body which was in a natural state; and I mention this to correct the ridiculous notions which have gone abroad, owing to some sayings which have been attributed to the French chemists. Raspail, for instance, is reported to have said that he could produce arsenic from the legs of chairs; and Orfila, that he could do so from the common soil. I have made experiments on hundreds of bodies of human beings and brutes, but have never discovered arsenic, unless it had been administered medicinally, or for a criminal purpose. I have also made many experiments on soils, and I believe the statement of Orfila is a mistaken one." (*London Med. Gazette*, vol. lxiv. p. 168.) As to the detection of arsenic in the *blood*, see *Pharmaceutical Journal*, vol. ix. p. 304.

In the case of Sophia Edney, convicted at Taunton, in England, of poisoning her husband, the contents of the stomach had, through mistake, been

A brief notice of a few cases may be added in this place:—

The case of Miss Blandy. This is interesting, as it gives us the mode pursued to detect arsenic a century ago.

Mary Blandy was tried in February, 1752, at Oxford, for poisoning her father with arsenic. It appears that she fell in love with a Captain Cranstoun, and that her father was averse to her marriage with him. The wretch then seems to have formed the plan of destroying him, in order to obtain possession both of his daughter and property; and for this purpose forwarded arsenic to Miss Blandy, which she was induced, from time to time, to mix in his food and drink. It produced prickings and heat in his tongue and throat, and burning pain in his stomach and bowels, which went off with vomitings and purgings. His health sunk under this dreadful regimen, and in particular he observed that his teeth decayed very rapidly. Several females, who had accidentally taken of the tea in which the poison was mixed, were also seized with vomitings and purgings, and suffered greatly. At last, on the 6th of August, she appears to have added a larger quantity than usual to his water-gruel. He was attacked with all his former symptoms, but with double violence; the abdomen swelled, and there was excessive pain and prickings over every part of his body. On the 10th, Dr. Anthony Addington visited him, and found his tongue swelled, his throat slightly inflamed and excoriated, his eyes inflamed, his pulse low, trembling, and intermitting, and

thrown away. An eighth of a grain of arsenic was, however, found in the duodenum. The only other matters brought for examination were a few grains of hog's fat, scraped from the edges of a frying-pan, and some potatoes, as the dying man stated that his wife had fried potatoes for him in this pan, and he had not been well since. No arsenic could be detected in the fat; and the potato "being an amylaceous substance, it was in vain to try the usual reagents or to make a filtered solution. It was, therefore, projected into melted nitre; when it was deflagrated, diluted acetic acid was added, to rather more than neutralize the carbonate of potash, resulting from the deflagration of the charcoal of the animal and vegetable substances." A stream of sulphuretted hydrogen was then passed through it, which turned it yellow; and upon deposition and subsequent reduction, with the other experiments already indicated, enough was obtained to take before a jury, of the reduced metal, arsenious acid, Scheele's green, arsenite of silver, and orpiment, although the reduced arsenic was not more than one-hundredth of a grain. (Herepath, Proceedings of the British Association, 1836, Appendix, p. 69.)

his respiration difficult; there was also an inability to swallow even the smallest quantity. The patient stated that he had had several bloody stools. During the next two days he appeared somewhat relieved, except that the rectum was ulcerated and painful; but on Tuesday, (13th,) a slight delirium, with a short cough, and ulcerous discharges from the rectum, supervened, and death ensued on Wednesday.

On Thursday the body was examined. "The back, and hinder part of his arms, thighs, and legs were livid. The heart was variegated with purple spots. The lungs resembled bladders half filled with air, and blotted in some places with pale, but in most with black ink. The liver and spleen were much discolored; the former looked as if it had been boiled, but that part of it which covered the stomach was particularly dark. The kidneys were stained with livid spots. The stomach and bowels were inflated, and appeared, before any incision was made into them, as if they had been pinched and extravasated blood had stagnated between their membranes; they contained nothing but a slimy, bloody froth; their coats were remarkably smooth, thin, and flabby. The wrinkles of the stomach were totally obliterated. The internal coat of the stomach and duodenum, especially about the orifice of the former, was prodigiously inflamed and excoriated. There was no scirrhus in any gland of the abdomen, no adhesion of the lungs, nor indeed the least trace of a natural decay in any part whatever."

A portion of the powder found at the bottom of the gruel administered to Mr. Blandy was handed to Dr. Addington. He gave a portion of this to Mr. King, a chemist in Reading, who examined it and declared it to be white arsenic. On the remainder he experimented himself, and came to a similar result. The question was asked him: Why do you believe it to be white arsenic? He replied, "For the following reasons:

1. This powder has a milky whiteness; so has white arsenic.
2. This is gritty, and almost insipid; so is white arsenic.
3. Part of it swims on the surface of cold water, like a pale sulphurous film, but the greatest part sinks to the bottom and remains there undissolved; the same is true of white arsenic.
4. This, thrown on red-hot iron, does not flame, but rises

entirely in thick white fumes, which have the stench of garlic, and cover cold iron, held just over them, with white flowers; white arsenic does the same. 5. I boiled ten grains of this powder in four ounces of clear water, and then passing the decoction through a filter, divided it into five equal parts, which were put into as many glasses. Into one glass, I poured a few drops of spirits of sal ammoniac; into another, some of the lixivium of tartar; into the third, some strong spirit of vitriol; into the fourth, some spirit of salt; and into the last, some syrup of violets. The spirit of sal ammoniac threw down a few particles of pale sediment; the lixivium of tartar gave a white cloud, which hung a little above the middle of the glass; the spirits of vitriol and salt made a considerable precipitation of a lightish-colored substance, which, in the former, hardened into glittering crystals, sticking to the sides and bottom of the glass; syrup of violets produced a beautiful green tincture. Having washed the saucepan, funnel, and glasses used in the foregoing experiments very clean, and provided a fresh filter, I boiled ten grains of white arsenic, bought of Mr. Wilcock, druggist, in Reading, in four ounces of clean water, and filtering and dividing it into five equal parts, proceeded with them just as I had done with the former decoction. There was an exact similitude between the experiments made on the two decoctions. They corresponded so nicely on each trial, that I declare I never saw any two things in nature more alike than the decoction made with the powder found in Mr. Blandy's gruel, and that made with white arsenic. From these experiments, and others which I am ready to produce, if desired, I believe that powder to be white arsenic."

Miss Blandy was condemned and executed, denying to the last any knowledge of a noxious quality in the powder she gave to her father.*

Case of Donnal. Mr. Donnal, a surgeon, at Falmouth, in England, was tried in 1817 for poisoning his mother-in-law, Mrs. Downing. It appeared in evidence that she had breakfasted and dined at the prisoner's house, in October, and returned home very ill, retching and vomiting, with a very

* Hargrave's State Trials, vol. x. p. 1.

violent cramp, and she continued so for three or four days after. On Sunday, the 2d of November, she was prevailed upon to drink tea with him. She was then in perfect health, and had just come out of church. Cocoa was provided for her, and while drinking part of the second cup she was taken very sick. Dr. Edwards was called in between 4 and 5 A. M. of the 3d, and found her very drowsy, and her pulse fluttering. According to the prisoner, she had been laboring under an attack of cholera morbus. Death followed in fourteen hours after taking the cocoa.

On dissection, the stomach was found partially inflamed, being stellated in several places. Its villous coat was softened, and in some parts nearly destroyed. The large intestines were also inflamed in different places. The lungs and liver were sound.

Dr. Edwards applied the liquid tests of sulphate of copper and ammoniaco-nitrate of silver to the contents of the stomach, and they each gave the characteristic appearances of arsenic.

On the part of the prisoner, it was urged that the disease was cholera morbus, and that in persons dead from it the stomach would present a similar appearance. Dr. Neale also deposed that he had tried the silver test on a decoction of onions, (the deceased had eaten onions on the day before she died,) and that a yellowish cloud was produced. He then varied the experiment by adding phosphate of soda, (the acid of which is present in the human fluids,) and a yellow precipitate fell down. The copper test used on the onions gave a green precipitate. He considered the reduction of the metal as the only decisive test. It is greatly to be regretted that this was omitted. The prisoner was acquitted.*

Mary Smith, a farmer's wife, near Dundee, was tried at Edinburgh, in February, 1827, for administering poison to her servant, Margaret Warden. The deceased was pregnant by the prisoner's son. It appears that the supposed poison had been twice given to her. From the first, which was taken at night, no decided effects seem to have occurred. She, however,

* The evidence on this trial is given in *Paris' Medical Jurisprudence*, vol. iii., Appendix, p. 277; and *Gordon Smith on Medical Evidence*, p. 212.

complained of pain, and was said to have vomited. The second dose produced thirst, vomiting, and purging, and violent pain in the bowels, and these were followed by prostration, stupor, cold extremities, and a feeble pulse. Death ensued in about 36 hours.

The body was disinterred twenty-two days after, and although there were marks of considerable putrefaction externally, yet the stomach and bowels were in a state of "wonderful preservation." The inner coat of the stomach was raised and separated in many places from the adjoining ones, and in other parts was corrugated or abraded. Blood was extravasated under it. The intestines also bore marks of vascular excitement.

The fluid found in the stomach amounted to ten or twelve ounces, and yellow particles floated in it. Similar particles also adhered to the villous coat, or were embedded in its substance. The physicians of Dundee examined a portion of the contents by the liquid tests, and then reduced some with the black flux. With each, indications of arsenic were given. Dr. Christison made a similar investigation, and also obtained the metal.

For the defence, the only points suggested were the possibility of cholera causing these fatal effects, and the uncertainty of post-mortem appearances after so long a period. The prisoner was acquitted. She may have been innocent; but the only satisfactory alternative is, that it was a case of suicide.*

Case of Wishart. The prisoner was accused of poisoning her pregnant sister. The porridge in which the arsenic was placed was eaten on Tuesday evening, and as far as testimony could be procured, the usual symptoms occurred. On Friday the deceased was delivered of a living child, and on Saturday she died. The body was disinterred eight days after. There was a small perforation in the stomach, and its villous coat was very vascular, and in some places abraded. The intestines were also very red.

* Syme's *Justiciary Reports*, p. 93; *Edinburgh Medical and Surgical Journal*, vol. xxvii. p. 141; vol. xxviii. pp. 84, 94. Mr. Alison (*Practice of the Criminal Law of Scotland*, p. 89,) says that the court considered this case as proved.

The contents of the stomach, and portions of that viscus, were submitted to the action of tests, but in none of these did the silver and copper tests give any indications of arsenic. Sulphuretted hydrogen, however, after the liquor had been acidulated with acetic acid, yielded a yellow precipitate, which was reduced by the black flux. Dr. Christison afterwards converted the crust, by repeated sublimation, into little octahedral crystals of oxide of arsenic, which he estimated to amount to about the fortieth part of a grain. In the stomach, there were appearances of the sulphuret. The prisoner was convicted and executed.*

The following, is a French case:—

In August, 1832, a couple named Terrier, and their mother, then in good health, experienced severe colic and nausea, followed by violent vomiting, after having eaten of cabbage soup. Several other persons who had partaken of it were similarly affected. The husband died in forty-eight hours, and his mother seventy-two days thereafter; while the widow, although her life was saved, continued incurably infirm. The disease present was pronounced to be gastroenteritis.

One Urbain X. succeeded to their property, and it was shortly ascertained that he was in possession of a large quantity of arsenic. On the 24th of July, 1832, he had called to dine with a brother and sister-in-law, and chatting about the quality of their new corn, expressed a wish to see it. The wife, who was about to bake, had recently put flour in the chest. She showed this flour to Urbain, who took up a handful of it, and in a few seconds threw it back again into the chest, saying it was better than his. On the 26th she made her bread. Her husband and son, herself, and ten other persons ate of it, and all were attacked with violent colic and frequent vomiting. If they resumed the use of the bread the sickness recurred; when its use was abstained from, it ceased. Bread was then made with other flour, proceeding from the same corn, and ground at the same time, and this produced no ill

* Edinburgh Medical and Surgical Journal, vol. xxix. p. 18; Syme's *Judiciary Reports*, Appendix, p. 1.

effect. Had the female and her son died, Urbain would also have inherited their fortune.

These facts led to a chemical examination of the bread. Two chemists were commissioned, but could find no deleterious substance. It was then committed to Orfila. He cut the bread into small pieces, treated it with distilled water, filtered the liquid, and tested it by concentrated liquid sulphuretted hydrogen. The fluid became instantly yellow, but was not sensibly troubled. A few drops of muriatic acid were now added, to precipitate any sulphuret of arsenic that might form. It was not until *several days had elapsed*, that a yellow precipitate, consisting of sulphuret of arsenic and organic matter, was deposited.

This precipitate was repeatedly washed with distilled water, then placed on a little filter, and washed with very weak ammonia. Thus the sulphuret was dissolved, and the organic matters left. The ammoniacal solution was now evaporated to dryness, and the residuum mixed with a little charcoal and carbonate of potash. Gentle heat was again applied, to drive off any further organic matter that might be present. And finally the watch-glass and its contents were pulverized in a mortar, and the powder introduced into a tube, the upper end of which was drawn out in the spirit-lamp. As soon as it became of a red heat metallic arsenic quickly appeared.

This evidence caused the conviction of Urbain.*

Case of Mina and Mrs. Chapman. This is a wretched story of adultery and murder, which occurred in Pennsylvania, in 1831. The prisoner became a lodger in the house of Chapman, the deceased, and either seduced his wife, or, which is more probable, was seduced by her. It would seem that there was an unsuccessful attempt to poison Mr. Chapman on the 17th of June, but of this he recovered. On Monday, the

* Annales d'Hygiène, vol. ix. p. 410; Lancet, N. S., vol. xii. p. 298. In another case, where a poisoned *bouilli* had been eaten, and several experimentalists declared that they could find no poisonous ingredients in it, Orfila found it equally refractory with tests until it had been boiled for a quarter of an hour, to remove the animal matter. The albumen present was thus coagulated, and after infiltration the liquor gave an abundant yellow precipitate with sulphuretted hydrogen. (Lancet, N. S., vol. viii. p. 318.)

20th, the arsenic was given to him in soup. He soon complained of burning heat in the stomach, and vomiting and purging appear to have followed; but no physician was called in, and no one saw him until the 21st, when Dr. Knight found him complaining of the above symptoms and thirst. He was deaf, his extremities were cold, and he was delirious at times, although no fever was present, and the pulse was very feeble. Dr. Phillips saw him on the afternoon of the 22d. He was now evidently moribund, the skin was shrunk, the hearing almost gone, and a bloody sanies or serum was passed by stool. He was calm, and rather comatose for an hour or two before death, which happened at 5 A. M. on the 23d.

It should be understood that the above physicians rather visited as friends than in their medical capacity, until the last day. Having heard of his illness, they called to inquire how he was.

On the 5th of July, Mrs. Chapman was married to Mina. When this became known, the death of Chapman, which had previously been ascribed to cholera morbus, excited suspicion and inquiry. His body was disinterred on the 21st of September. The face was livid and putrid, but the odor of the corpse was not offensive. The abdomen was of a pale white color, and Dr. Hopkinson, on cutting into it, was struck with its firmness and resistance. When the stomach was opened, a very peculiar smell arose, which he compared to pickled herring. This is confirmed by several other medical witnesses.* Externally the stomach was of a dark color; internally, its whole surface was covered with a dark brownish-colored mucus, and when this was removed, it presented appearances of general inflammation in every part. The intestines were totally empty, of a pale color, and apparently rather disposed to dry than to putrefy. The rectum was not examined; the cesophagus, at its lower part, was highly inflamed.

The stomach and its contents were taken to Dr. J. K. Mitchell,

* Dr. Mitchell subsequently obtained a stomach and put it into a small quantity of Fowler's solution (arsenite of potash). It remained in his laboratory some two or three months, and then had, as he thinks, precisely the same smell.

of Philadelphia, for examination. No gritty particles could be discovered adhering to its coats. The process decided upon was to remove the viscid mucus, with which the walls of the stomach were lined, and subject that to one mode of analysis, and then the solid stomach and intestines to another.

Distilled water was added to the mucus, and the whole boiled in a Florence flask for a considerable time. The fluid was then thrown on a filter. The matter left on it (a dark brown substance) with the filter itself, was thrown into nitric acid, in which the stomach and duodenum were undergoing solution. The filtered liquor was transparent, and of a faint amber yellow color. Portions of it were subjected to the liquid tests. The copper one gave an *undecided grass green*; nitrate of silver, a brownish-yellow flocculent precipitate, which grew darker, and soon lost its yellowness; sulphuretted hydrogen gas deepened the yellow tint of the solution just perceptibly. The whole of the liquid was then subjected to the last test: thrown into a capsule, heated until it became distinctly yellow and its transparency was gone. The whole was then left on a filter for several hours. When again examined, a transparent liquid was seen below the filter, and on it a yellow substance which could not be separated from it, being in too small a quantity and the paper not being smooth. From the quantity being so minute, no hope was entertained of obtaining any marked result, and the whole (filter and all) was thrown into the vessel in which the stomach was dissolved. This solution was evaporated to dryness, heated again with nitric acid, and evaporated until it was supposed that the animal matter was destroyed. Water was added to the residue, and heat to boiling again applied. To the product obtained by filtration and evaporation, lime-water was added, and this again evaporated. A portion of this was mixed with charcoal, placed in a glass tube, and subjected to the heat of a spirit-lamp. The tube became covered, at some distance from the material, with a black and glistening substance, but at this instant the tube cracked from the action of the heat. Mr. Clemson, a highly educated chemist, instantly detected the odor of arsenic. The other portions were treated in a similar manner, but nothing beyond the black matter just described could be obtained. "There was

no evidence to the eye," says Dr. Mitchell, "that there was any arsenic there."

For the defence, the insufficiency of the testimony, as to symptoms, morbid appearances, and chemical proofs, was greatly dwelt upon. The medical witnesses mention the sources of fallacy in each. One of them stated, that from the best of his impressions, "from the symptoms, post-mortem examination, and chemical tests, William Chapman did not die of arsenic."

Mina was convicted, and Mrs. Chapman found not guilty.*

* Trials of Lucretia Chapman and Lino A. E. Y. Mina for the murder of William Chapman; prepared for publication by William E. Du Bois, student at law. 8vo. Philadelphia, 1832.

I may also refer to the following cases, which my limits do not permit me to analyze:—

Case of Nairn and Ogilvie, for poisoning the husband of one and the brother of the other; tried at Edinburgh in 1765. The symptoms resembled those from taking arsenic, but the body was not examined, in consequence of the advanced state of putrefaction. The accused were convicted. (Hargrave's State Trials, vol. x. p. 479.)

Case of Miss Burns. I have noticed this in the previous volume, (p. 362.) as to the proofs of pregnancy. Mr. Angus was also indicted for poisoning her. The symptoms were equivocal, but suspicious; and on dissection a perforation of the coats of the stomach was found. Around this opening the parts were extremely soft, pulpy, and tender; but there were no traces of inflammation. No poison could be detected in the fluids. With our increased knowledge on the subject of diseases of the stomach, it becomes at least possible that the morbid appearance in question may have been the result of ordinary illness. (Edinburgh Medical and Surgical Journal, vol. v. p. 220; Rutter's Vindication.)

Trial of John Lovie, for poisoning a female. (Edinburgh Medical and Surgical Journal, vol. xxix. p. 415; Syme's Justiciary Reports, Appendix, p. 24.)

Case of Eliza Fenning. This is remarkable for the evidence derived from symptoms—a whole family having been taken ill shortly after eating the poisoned dumplings; for the imperfect chemical examination and testimony; and for the conviction of, as I suppose, an innocent person. (See Dr. Watkins' pamphlet on this case, London, 1815; Marshall's Remarks on Arsenic, London, 1817; Gordon Smith on Medical Evidence, p. 207; and Hints on the Examination of Medical Witnesses, p. 136.)

Trial of Mary Higgins and Edward Clarke, for the murder of the uncle of the former: related by Prof. Amos. (London Medical Gazette, vol. ix. p. 896.)

Trial of the widow Boursier and Nicholas Kostolo, for poisoning Boursier. Notwithstanding the positive discovery of arsenic in the stomach of the deceased a month after burial, the female was acquitted. (Causes Célèbres,

Discovery of arsenic several years after death. The following cases are highly interesting as proving the possibility of the

du XIX. Siècle, vol. iii. p. 105; Edinburgh Medical and Surgical Journal, vol. xxi. p. 238.)

Case of the widow Laurent, accused of poisoning her husband. (Anderson's Journal, vol. ii. p. 306; Medico-Chirurgical Review, vol. vii. p. 289.)

A case by Ristelhueber, p. 161.

A case quoted in the Quarterly Journal of Foreign Medicine and Surgery, vol. ii. p. 103, from Rust's Magazine. Here, the chemical examiners being dissatisfied with the equivocal results obtained from testing the fluid contents of the Stomach, took that viscus and boiled it down. The liquid procured, after removing organic mixtures, yielded metallic arsenic.

In this country—

Case of Kesler, tried in this State in 1817, for the murder of his wife. I omit this, not because I have changed my opinion concerning it, or entertain any doubts that he poisoned her, but because its notice would occupy too disproportionate a space. As to the defects in the medical testimony, they at least have been sufficiently arraigned.

Case of Williams, convicted of the murder of his wife, in November, 1830, in Pennsylvania. She died five hours after taking a white powder, represented by him to be magnesia. Thirst, burning of the stomach, sickness, and bloody vomiting were present. She was disinterred twenty-four hours after burial. The inner coat of the stomach was extensively inflamed, and white particles were found adhering to it, particularly at that part where the inflammation was greatest. The contents of the stomach were tested with the silver and copper tests, but neither of them presented the appearances indicative of arsenic. The remaining contents were then evaporated, covered with nitric acid, and again evaporated. The residuum was mingled with charcoal, placed in a glass tube, and sublimed; metallic arsenic was readily obtained. The prisoner was convicted. The case is communicated by Dr. Worthington. (North American Medical and Surgical Journal, vol. xi. p. 229.)

Case of B. Becker, for murdering his wife, in Montgomery County, New York, in 1814. Here arsenic was found in the coats of the stomach, and its presence proved by the liquid tests, the copper plates, and the garlic smell. Before execution he confessed his guilt.

Case of A. Hitchcock, for poisoning his wife. He was tried in Madison County, in this State, in 1807. The mucous coat of the stomach was denuded in several places. Here also particles were obtained from the stomach, and the usual tests applied. "Some of the powder was put on a copper plate, suspended over a lamp, and above this another copper plate was held. In a short time the white fumes ascended, and hung on the upper plate, in the form of white arsenic." One of the medical witnesses for the prisoner urged in his favor that no sphacelation was discovered. We now know that this is very uncommon. The prisoner was also convicted, and confessed his guilt.

Case of Medad McKay, tried twice in Alleghany County, New York, 1820

discovery of arsenic many years after death. An individual who died in 1822 was disinterred in 1829, at Bourg, in France.

and 1821, for poisoning his wife. The prisoner escaped, through the imperfection of the chemical examination. This trial has been reported and published by Mr. Gould, Albany, 1821.

Case of Sager, tried in the State of Maine, October, 1834, for poisoning his wife. Here, extreme distress was *immediately* experienced after taking the poison. It was added to wine, in which an egg had been stirred. Nausea, retching, and vomiting succeeded, with violent spasms, great distress at the stomach, feeble pulse, and cold sweats. The vomiting was stained with blood toward the last. She preserved her reason until near her death, which happened in a few hours. On dissection, livid patches were found in the stomach, as if blood was collected between the coats; the remainder of that viscus and the intestines were of a high florid color. In some tea and milk which had been prepared for breakfast, arsenic in large quantities was discovered by the three liquid tests, and by reduction. The silver and copper tests would not act on the contents of the stomach or the matter vomited; but Professor Cleaveland, who was the principal chemical witness, found sulphuretted hydrogen to produce its usual result on them. The counsel for the prisoner, in his able defence, urged that there was no swelling of the body, no paralysis, no drowsiness, no trembling of the limbs, and no loss of reason present in this case. If the distinctions under the heads of symptoms be adverted to, a ready explanation may be given for their absence. The prisoner was convicted.

Trial of John Earls, for the murder of his wife, held in Lycoming County, Pennsylvania, February, 1836. I am indebted for this pamphlet to the Hon. Ellis Lewis, the judge who tried the prisoner. I know of no case to which I would sooner refer than this, as a proof of the advanced state of medical jurisprudence in this country. The murdered female was confined on Wednesday, and was so well as to sit up on Thursday, to have her bed made. She was seized with violent vomiting in the evening, after partaking of some chocolate. Some mint tea, also drugged with arsenic, (as the husband confessed, after conviction,) was now administered. The vomiting continued, with violent pain, particularly in the stomach, intense thirst, until she finally sunk, and died at three o'clock the next morning. On dissection, the coats of the stomach were found highly inflamed, and easily separable; the intestines were also inflamed; the brain turgid, and the right and left auricles and ventricles of the heart each filled with blood. A portion of the fluid found in the stomach was examined with the usual tests, and gave complete indications of arsenic. The process of reduction was also performed. The chemical examination confers great credit on Drs. Dougal, Kittoe, and Ludwig. To make assurance doubly sure, a part of the suspected fluid was transmitted to Dr. John K. Mitchell, of Philadelphia, who confirmed the previous results. The prisoner confessed the crime previous to his execution.

The following may be added, as worthy of a careful perusal:—

Analysis of soup containing arsenic, from which a female died at Baltimore, by Dr. Rogers, and Messrs. Andrews and Fisher. After being filtered and eva-

The body was entire; the head, trunk, and shoulders had preserved their former position, but the internal organs of the chest and abdomen were destroyed, and there only remained a mass of soft brownish matter, which was deposited along the sides of the spine. Messrs. Ozanam and Idt were, under these circumstances, appointed to examine the case.

porated to dryness, it was sublimed with black flux, and gave metallic arsenic. The round of liquid tests was then applied, with corresponding results. It was also reduced with boracic acid and charcoal, as advised by Rose, and a ring of specular metallic crystals was produced. A galvanic circle, as proposed by Fisher, was tried, and the copper rod was found coated with a silvery-white deposit. No indications of arsenic could, however, be obtained from boiling the coats of the stomach. (Philadelphia Journal of Pharmacy, vol. vi. p. 94.)

Analysis of bread in which arsenic had been placed by mistake, and which caused the death of two persons in Maryland, by Messrs. Tyson and Fisher. It was treated with nitric acid in excess, and a few drops of muriatic acid, and evaporated, in order to drive off organic matters. The residuum was treated with boiling water, and filtered. It gave indications of arsenic, with lime-water, the copper test, and sulphuretted hydrogen. The sulphuret was then reduced in glass tubes. (Ibid., vol. vii. p. 107.)

I observe that M. Paton advises, as the best method for detecting arsenic in bread, that it be crumbled down, digested in hot water for half an hour, and filtered. An infusion of galls made in the cold is then to be added, and after filtering the solution, the clear liquor may be tested for arsenious acid. (British Annals of Medicine, vol. i. p. 241.) The infusion of galls is intended to precipitate the animal matters, and he has, therefore, recommended it in all cases where arsenic is supposed to be mixed with organic solids or fluids. Berzelius, however, observes that it is not by any means certain that this method is preferable to Taufflieb's, viz., precipitating the animal matters by a solution of oxide of zinc in caustic potash. (Journal de Pharmacie, vol. xxiv. p. 179.)

In a case of poisoning with beans, the question was put to Barruel and Chevallier, whether the beans had been impregnated by arsenic during the process of boiling; and they replied in the affirmative, on finding the poison in the epidermis, and also in the beans when deprived of their epidermis. To ascertain the presence of arsenic, they placed six in a vessel, added distilled water, and applied heat. A part of the decoction was next filtered, which, on the application of sulphuretted hydrogen, gave the peculiar yellow of sulphuret of arsenic. This operation was repeated several times on the same beans, with similar results, although of course the process became more tedious and the quantity indicated less. The sulphuret was consequently evaporated to dryness and then reduced. (Annales d'Hygiène, vol. xv. p. 387.)

The cases of Mercier and Madame Laffarge, which I have noticed in American Journal of Med. Sciences, October, 1841.

A part of this matter was boiled in repeated portions of distilled water, till the water ceased to carry away with it any impregnation. The solutions thus obtained were subjected to two series of tests. 1. One portion was evaporated to dryness, and the extract redissolved. This solution was repeatedly evaporated, and then deflagrated with nitre. The saline residue, being dissolved, filtered, and boiled with nitric acid, and saturated with pure potash, was now operated on with the tests of arsenic. Hydrosulphate of ammonia and the silver tests gave their precipitates, and a portion of this last was sublimed by heat in a tube. On passing a stream of oxygen over these crystals, and dissolving them in distilled water, the usual tests of white arsenic were found to apply. 2. Another portion was treated with sulphuretted hydrogen and a little muriatic acid, and the precipitate was reduced in a tube with charcoal and potash. A brilliant incrustation was procured, which, when treated as in the former instance, became a solution of oxide of arsenic.*

In another instance, the body of a female was disinterred at St. Martin, in France, in 1836, after having been buried three years. Suspicions of poisoning had previously existed, but they gradually died away, until a felonious attempt on one of the neighbors revived their currency. The body was perfectly identified; it was in a state of remarkable preservation, and was conveyed to Paris for examination by Barruel, Henry, and Ollivier D'Angers. The parietes of the abdomen were untouched, without any crevice or opening, and sunk in upon the vertebral column. On raising these, the viscera of the thorax and abdomen could not be distinguished, all being converted into a mass of membranous flakes, and between them a quantity of a granulated, pulverulent, brownish substance was observed. Each of these was carefully removed and examined. No noxious matters could be detected in the latter. The flakes were then tested for lead, antimony, copper, and arsenic. In pursuing the inquiry, a strong presumption arose in favor of the presence of the last, and the following course of investigation was thereupon pursued:—

* Edinburgh Medical and Surgical Journal, vol. xxxiii. p. 453; Orfila's *Exhumations Juridiques*, vol. ii. p. 330.

A portion of the flakes, cut into small pieces, was macerated for twelve hours in distilled water, acidulated with pure muriatic acid. After this the liquor was boiled for several hours. On cooling and filtering, a clear brownish fluid was obtained, covered with thick scum, which was readily separated. The fluid, which was strongly acid, was partly neutralized by pure ammonia, and a current of sulphuretted hydrogen was then passed through it. This produced a brownish precipitate, which, in the course of forty-eight hours, was completely deposited. The clear liquid now remaining was found, on analysis, to contain nothing more than a small portion of salts of no importance.

The precipitate, on being washed, redissolved in ammonia, and gradually evaporated, left a residue of a dark-brown friable substance. One part of it was added to alcoholized potash, and carefully dried until it became pulverulent. Mixed with the black flux in a glass tube and heated, a shining metallic ring of a steel-gray color was produced, being *metallic arsenic*. The other portion was mixed with pure nitrate of potash and calcined. A saline white mass was thus obtained, perfectly soluble in distilled water. After being thus dissolved and exactly neutralized by nitric acid, nitrate of silver was added, and it caused an abundant *brick-red* precipitate, being the *arseniate of silver*. Finally, to leave no doubt on the subject, the metallic arsenic first obtained was oxidated by the application of heat, and its solution tested with nitrate of silver, ammoniacal sulphate of copper, and sulphuretted hydrogen,—all of which gave their characteristic appearances.

The criminal (a female) was condemned to imprisonment for life.*

* Annales d'Hygiène, vol. xviii. p. 466 ; Journal de Pharmacie, vol. xxiii. p. 386. When arsenious acid has remained for some time in dead bodies, particularly if putrefaction has advanced, it becomes converted into arsenite of ammonia, and should be sought for in that state. It is much more soluble than the acid. (Devergie, vol. ii. pp. 719, 732.)

The following are additional cases: London Medical Gazette, vol. xxxv. p. 655, by Professor Wolher, in which arsenic was discovered in a body buried seven years ; *ibid.*, vol. xliii. p. 894, Professor John W. Webster, in a body interred fourteen years ; *ibid.*, vol. xliv. p. 168, Mr. Herepath, in one buried eight years.

For the detection of absorbed arsenic in the tissues, see Taylor, p. 363.

There is one question that remains for consideration, and I have delayed its notice until now, that the reader may consider it in connection with the cases that have been given. It is, *whether we are authorized in declaring a person to be poisoned with arsenic from the symptoms merely?* In the first edition I considered this at some length, and inclined to the affirmative, and I am happy to say that so distinguished a medical jurist as Dr. Christison has advanced similar sentiments.

There is in most of the cases of poisoning by arsenic, if they be at all protracted, so remarkable a union of symptoms, that they can hardly be confounded with natural disease. The marks of irritation extending from the throat to the rectum, the difficulty in swallowing, the pain in the bladder on passing water, the affection of the genitals, the vomiting and bloody diarrhoea, the extreme weakness—all these, combined as they often are with nervous symptoms, present a group of symptoms that is certainly extremely unusual in ordinary practice. In connection with this, the fact that a person is attacked soon after eating a meal or taking some drink, and particularly if a number of individuals be simultaneously affected, offers additional weight to the suspicion.

A family residing in the parish of Keig, in Scotland, and consisting of two brothers and two sisters, were taken ill on the morning of the 19th of August, 1821, shortly after eating breakfast. They were all previously in good health, and the dish of which they ate was porridge, consisting of milk, salt, and meal. William Mitchell, one of the brothers, partook largely; but James, who perceived a sickening taste, took less than common, while the sisters had their usual quantity. They were all seized with vomiting, burning heat in the stomach, weakness, and fainting, which continued for a considerable length of time, and William finally sunk after seven days. The others gradually recovered, but great debility remained for some months. On dissection, the stomach and intestines presented unequivocal marks of inflammation.*

No part of the salt and milk used that morning was to be

* Cases of poisoning, by Mr. Murray. (Edinburgh Medical and Surgical Journal, vol. xviii. p. 167.)

found, but the remainder of the meal, and also the contents of William Mitchell's stomach and duodenum, were examined by several physicians and surgeons. No poisonous ingredient, however, could be detected.

In this instance, a family in good health was simultaneously attacked with symptoms that indicated a *common cause*, and there was no epidemic prevalent that would account for them. So violent, too, did the cause in question prove, that the individual who had partaken most largely sunk under its effects. Under these circumstances, the brother-in-law of the deceased was tried, and the medical witnesses did not hesitate to give it as their opinion that poison had been administered to his relatives. He afterwards confessed his guilt, and stated that he had perpetrated the crime by means of arsenic put among the salt on the morning when the Mitchells were taken ill.

It is not probable that this question will arise so frequently as it has formerly. The improved modes of detection, and searching for the poison in the tissues of the stomach, will undoubtedly diminish the number of cases in which, notwithstanding the positive nature of other testimony, no poison could be detected by the best chemists. If a medical witness ever find it necessary to give such an opinion, it should be founded on a strong combination of circumstances, a marked peculiarity of symptoms, and a striking disorganization of parts.*

[Orfila, in 1838, announced his opinion, based upon experiment, that arsenic is a normal constituent of the animal organism, especially in the bones. Devergie assented to the correctness of this opinion, and these chemists gave rules for discriminating *normal arsenic* from that extraneous to the system. The experiments of other chemists, and subsequent researches of Orfila himself, have abundantly demonstrated the fallacy of his early experiments. M. Handin shows that Orfila probably mistook the effects of phosphite and sulphite of ammonia for those of arsenic.†—St. J.]

* For Dr. Christison's views, see Edinburgh Medico-Chirurgical Transactions, vol. ii. p. 308; Toxicology, 2d ed., p. 295. It is proper to add that most medical jurists deem it unsafe to rely on symptoms alone.

† Flandin, vol. i. p. 728; Lehmann's Physiolog. Chemistry, vol. i. p. 449; Taylor, p. 371.

In the chemical examination of exhumed bodies, an important question presents itself. May not arsenic have been derived from the surrounding soil of the graveyard? Some soils unquestionably do contain arsenic in soluble and insoluble forms, and analyses of the earth in the vicinity of the body are indispensable to conclusive results.*

Treatment. It will not comport with the object of this work to enlarge much on the present topic, but it is, notwithstanding, proper briefly to notice the most approved mode of obviating the effects of the poison.

AS TO ANTIDOTES, the *sulphuret of potash* once had a high reputation, but we have already shown that this is itself a poison. Renault tested its efficacy on animals, and found that they died even sooner when this pretended antidote was administered, than when they had taken the arsenious acid solely.† *Sulphuretted hydrogen* was rather more successful, but only when the poison was taken in a fluid, and not in a solid form. *Sulphur* has been suggested, on the principle of its uniting with the arsenic, but even this has little effect. *Charcoal* has been recommended, in consequence of the experiments of Bertrand, and it would seem to have attained a partial celebrity. The results obtained by Orfila are, however, destructive to its character, and I should consider it very hazardous to depend on this substance.‡ Dr. Garrod has presented it as an antidote in the form of *animal charcoal*, but I doubt whether the profession generally concur in his opinions.

There was a period, some years since, when the *hydrated sesquioxide of iron* accumulated much testimony in its favor as an antidote. This substance is prepared by taking a pure solution of the subsulphate of iron, increasing its dose of

* Flandin, *Traité des Poisons*, vol. i. pp. 674, 741; Galtier, vol. i. p. 368; *Comptes Rendus*, September, 1846; *Brit. and For. Review*, July, 1855, p. 232; Taylor, p. 376.

† *Edinburgh Medical and Surgical Journal*, vol. vii. p. 90; Orfila's *Toxicology*, vol. i. p. 141.

‡ Orfila's *Toxicology*, vol. i. p. 500; vol. ii. p. 470. Dr. Chisholm says that the juice of the sugar-cane is an antidote, and states that it has been tried on animals in the West Indies with complete success. (*Brande's Journal*, vol. x. p. 193; *Edinburgh Med. and Surg. Journal*, vol. iv. p. 416.)

oxygen by heating it with nitric acid, and then pouring into the solution an excess of caustic ammonia. The hydro-oxide is now obtained by decantation.

The dry, hydrated oxide is inert, but the substance, when prepared, may be kept for any length of time under water.

"The dose for a grown person is a tablespoonful, and for children a dessertspoonful, to be given every five or ten minutes until relief is obtained."

Arsenious acid will unite with oxide of iron and form an insoluble salt, the arsenite of iron, which was at one time supposed to be, and probably is when given as arsenite of iron, but slightly poisonous. But the requisitions for an antidote are not met in the present case. "Every supposed chemical antidote," says Christison, "will prove useless which does not render the arsenic insoluble, not only in water, but likewise in the contents and secretions of the stomach." We are never sure that sufficient of the *hydrated oxide* has been given to produce even the doubtful arsenite, which, according to Orfila, is itself poisonous. Still this substance should be freely given, to aid the other remedies to be recommended. We have many cases recorded in which it relieved unfavorable symptoms, and, indeed, appears to have saved life.*

It should be understood that other preparations of iron have been recommended as antidotes. The subcarbonate of iron, largely suspended in water, (four ounces in twenty-four,) was found efficacious in experiments on dogs, by a committee of the

* See Bunson and Berthold's Experiments, *Lancet*, N. S., vol. xv. p. 126; London and Edinburgh Phil. Mag., vol. vi. p. 237; Orfila's Toxicology; Bouley, in *Annales d'Hygiène*, vol. xiv. p. 134; Van Speez in *British and Foreign Med. Review*, vol. iv. p. 237; Miguel and Soubeiran, of Paris, and Borelli and Demaria, of Turin, *ibid.*, vol. i. pp. 594, 595.

Cases of recovery are given by Dr. Leger, in *American Journal of Medical Sciences*, vol. xvi. p. 239; Mr. Robson, in *London Med. Gazette*, vol. xix. p. 177; see also *ibid.*, vol. xvi. p. 832; Dr. MacDonald, in *New York Journal of Med.*, vol. ii. p. 205; Dr. Gerhard in *Philadelphia Med. Examiner*, vol. iii. p. 250; Drs. Smiley and Wallace, in *ibid.*, vol. iii. p. 680—out of eight persons poisoned, six were greatly relieved by the antidote, and recovered. In two, it was rejected by vomiting, and they sunk. Dr. Douglas Maclagan, in *Edinburgh Med. and Surg. Journal*, vol. liv. p. 106; Dr. Puchett, in *ibid.*, p. 262; Dr. Chilton, in *United States Med. and Surg. Journal*, vol. iii. p. 54. These are only a selection of favorable cases.

Royal Academy of Medicine of Paris, and we have some cases of recovery with it on the human subject.*

Duflos, after stating that the hydrated peroxide, although of admitted efficacy in cases where uncombined arsenious or arsenic acid has been taken, is wholly ineffectual when these acids are combined with bases, as in arsenite of potash, (Fowler's solution,) or arseniate of potash, advises the free use, in these last, as a substitute, the peracetate of iron, made by adding diluted acetic acid to the hydrated peroxide, prepared in the usual way. It should be given largely, diluted with water.†

The indications in a case of poisoning, are: 1. To remove the poison. 2. To prevent its injurious consequences on the stomach and system generally.

The first is attempted by means of an emetic, as the sulphate of zinc; but if vomiting be present, we may aid it by diluents in small quantities.‡ Tartrite of antimony should never be given. But when vomiting does not take place immediately, from the means just directed, the urgency of the case warrants us in using more direct remedies. Renault recommends that the stomach be washed and emptied mechanically, by means of a large tube of elastic gum and a syringe. In this way, a certain quantity of liquid may be thrown in, to dilute or suspend the poison, and by the action of the syringe, the whole may be again withdrawn.§ The *stomach-pump* has in this way proved a useful assistant in some cases; but it is most valuable in instances of poisoning with opium.||

* British and Foreign Med. Review, vol. viii. p. 574; Medico-Chirurgical Review, vol. xxxvii. p. 592.

† London, Edinburgh, and Dublin Philosophical Magazine, vol. xxv. p. 486.

‡ In a case related by Mr. Kerr, (Edinburgh Med. and Surg. Journal, vol. xxxvi. p. 94,) where a large quantity of solid arsenic had been taken, and vomiting did not occur for an hour afterwards, he continued the exhibition of sulphate of zinc and ipecacuanha, to the amount of 175 grains of the one, and 230 of the other, all in the space of three hours. Copious vomiting ensued, and the patient recovered. Mr. Kerr particularly cautions against the too free use of diluents. Strong and complete contractions (he observes) of the stomach are required to throw off the poison, and these cannot take place if that viscus be distended with liquids.

§ Edinburgh Medical and Surgical Journal, vol. vii. p. 91.

|| Renault, and even Boerhaave, have proposed its use, so that the contest of late years about the priority of its invention is evidently futile Dr. Physick,

2. In several instances, the free use of magnesia has proved of service. Mr. Joseph Hume was, I believe, the first who administered this article. Copious vomitings had already occurred, and retchings and pain continued. Under these circumstances, he gave carbonate of magnesia very freely, with tincture of opium, suspended in water. In five days the patient was well.*

Inflammation of the stomach is not an uncommon secondary consequence in those who survive; and Dr. Yelloly first suggested that it should be treated accordingly. In Dr. Roget's case, it succeeded perfectly; and several instances have since occurred, in which venesection, blisters, etc. were used with the happiest results.† Opium, after free depletion, is also useful.

of Philadelphia, published a paper in 1812, in which he mentions that he *successfully* applied the syringe to a child poisoned with laudanum, and Dr. Dorsey afterwards cured two individuals by the same treatment. This distinguished surgeon, however, subsequently states that Dr. Alexander Munro, Jr., first suggested the invention in 1797, although he (Dr. Physick) was ignorant of this fact when he applied it practically. I conceive Dr. Physick is entitled to the *honor of having been the first who saved life by its means*. (See Eclectic Repertory, vol. iii. pp. 111 and 381; and American Med. Recorder, vol. vi. p. 294.)

A case in which a drachm of arsenic, mixed in ale, was taken, and removed so effectually by the stomach-pump that no inflammatory symptoms followed, is mentioned in British Annals of Medicine, vol. ii. p. 80. Venesection and purges were, however, employed.

* London Medical and Physical Journal, vol. xlv. p. 466. Mr. Edwards, in *ibid.*, vol. xlix. p. 117, and Mr. Buchanan, in London Medical Repository, vol. xix. p. 288, have published similar cases. In both, however, copious vomitings had already occurred, and in the former venesection was required to complete the cure. I may here subjoin a notice of some cases *cured* apparently by means not included in the above directions. Dr. Heron, of Orange County, New York, injected milk, in which the whites of eggs were beaten up, with the stomach-pump, in the case of a man who had swallowed nearly an ounce of arsenic. A free discharge was procured, followed by vomiting, and the arsenic was found enveloped in the coagulum that was thrown up. The patient after this experienced no bad effects from the poison. (United States Medical and Surgical Journal, vol. ii. p. 468.) The Rev. Ralph Emerson relates two cases in which arsenic had been swallowed, and where *tobacco-juice* was given to induce vomiting, but without effect. Neither was there any cathartic operation. The pain, however, gradually subsided, and the patients recovered, in one case after taking an emetic, and in the other without using any medicine. (Silliman's Journal, vol. xxxi. p. 188.)

† McLeod, in Edinburgh Med. and Surg. Journal, vol. xv. p. 553. Davies,

Medical police. It is certainly a duty that legislators owe to their constituents, and sovereigns to their subjects, to restrain the sale of this dangerous article; and I am happy to add, that in several countries, proper regulations exist. In France and Prussia, the sale of arsenic is strictly guarded.* In the State of New York, the following is now in force: All apothecaries, druggists, or other persons selling arsenic, corrosive sublimate, prussic acid, or any other substance or liquid usually denominated poisonous, shall have a printed or written label, with the word "Poison," on the phial, box, or parcel containing the same; and in case they sell tartar emetic, its name shall be attached in the same manner. The breach of this is declared a misdemeanor, and punishable by a fine not exceeding one hundred dollars.† But although the danger of accidental poisoning is thus diminished, there is not a sufficient check upon its criminal employment. Why should all and every one be allowed to purchase this virulent substance?

The *black oxide of arsenic* deserves attention, since it is the basis of the *fly-powder*, which is much used in France and Germany to destroy animals, and hence may often be the cause of accidental poisoning. It is commonly deemed to be a mixture of metallic arsenic and the white oxide. Renault, in his experiments on dogs, found it quickly mortal; and when it had acted sufficiently, it produced in the stomach an exudation of blood, and infiltration of the same between the coats of that viscus, without any trace of erosion.‡ Jaeger witnessed the death of a girl, aged sixteen, who was poisoned by drinking water that had stood on it. She made no complaint of pain, and retained her senses to the last, asking for everything she wanted. Nine hours after death the skin exhibited no change, except its paleness and a few blue spots on it. On dissection, a slight spotted redness was found about the cardia; the bottom of the stomach was discolored, and there was a small brown

in London Medical and Physical Journal, vol. xxviii. Skillman, in American Journal of Medical Sciences, vol. xviii. p. 531.

* Edinburgh Med. and Surg. Journal, vol. ix. p. 351; vol. xiii. p. 143.

† Revised Statutes, vol. ii. p. 694.

‡ Edinburgh Medical and Surgical Journal, vol. vii. p. 90.

spot where the villous coat seemed as if superficially burnt.* In several cases quoted by Orfila, the stomach was inflamed, and red spots, with extravasated blood, were present.†

In a case that occurred to Dr. Wagner, a child drank some from a cup, and death ensued in twelve hours; yet the most careful analysis of the intestinal canal and its contents did not detect any vestige of it. This is ascribed to the previous vomiting, and the small quantity taken.‡

From the nature of this substance it is evident that it may be detected by the application of heat. This will sublime the white oxide and form the bright metallic crust. By solution in water also, and the application of tests, the characteristic proofs of the oxide will be exhibited.

Arsenites. Two of these are in use, and may become the cause of poisoning: the *arsenite of copper*, (Scheele's green, mineral green;) and the *arsenite of potash*, (Fowler's solution.)§ The former is used as a paint, and is sold in cakes.|| The latter is employed as a medicine, and sometimes called the tasteless ague drop.¶ Both of them may be detected by the addition of acetic acid, and then heating the mixture. Sul-

* Edinburgh Med. and Surg. Journ., p. 80.

† Orfila's Toxicology, vol. i. p. 160.

‡ London Medical Quarterly Review, vol. ii. p. 488. I place also under this head the case of poisoning from cobalt, by Dr. Hurd. (Boston Med. and Surg. Journal, vol. xxxi. p. 316.) A child, two years old, swallowed some *cobalt*, prepared to kill flies. Vomiting soon ensued, which left comparative ease; but he soon grew worse, with the usual symptoms of sinking, small pulse, cold extremities, much writhing, etc., and died seven and a half hours after taking the poison. (The *cobalt* is *arsenic*.)

§ For cases of poisoning by arsenite of copper, in confectionery, in green oil-paint, and in paper-hangings, see Taylor on Poisons, pp. 386, 743.

|| The mineral green commonly sold in shops is not an arsenite, according to Dr. Christison. By analysis, he ascertained it to be a mixture of the hydrate of copper and carbonate of lime. (Page 258.)

¶ When given in too large doses as a remedy, disastrous consequences may follow. Dr. Astbury (Edinburgh Medical and Surgical Journal, vol. xv. p. 415,) relates a case of this description. Vomiting is an early symptom.

There is also a case given in the Encyclographie des Sciences Médicales for February, 1844, of death occurring in a person laboring under ague, who took a quack solution, containing, as near as I can make out the figures, about five grains of the arsenite of potash. This dose was taken at 6 A. M., and he died at night, after great suffering and the usual symptoms.

phuretted hydrogen is then transmitted through it, and in the one case the sulphuret of copper is separated from the sulphuret of arsenic by the addition of ammonia. The reduction of the sulphuret is then to be effected as already directed.

A boy, three years old, the son of a painter, poisoned himself by licking a shell covered with Scheele's green. In half an hour he became pale and ill. Vomiting ensued, with diarrhoea, pain in the abdomen, and burning thirst. The peroxide of iron was given in divided doses, and in half an hour these symptoms had ceased, and the patient was well the next day.*

Another case is given of a child, a year old, who, unobserved, ate a portion of a cake of green ink, which was subsequently ascertained to consist of arsenite of copper. It produced constant vomiting, which was aided with ipecac., and subsequently whites of eggs and milk were administered. Diarrhoea, with symptoms of great debility, succeeded, but the infant survived.†

Dr. Basedow asserts that if Scheele's green be employed in painting apartments, it may give rise to a dangerous evolution of arseniuretted hydrogen gas, under the influence of moisture.‡

Arsenic acid is to be considered as a more violent and rapid poison than even arsenious acid. This was abundantly proved by the experiments of Brodie, Jaeger, and Campbell. Its action is, however, similar.

There are two cases on record, according to Dr. Christison, of poisoning with *arsenite of potash*. This substance is very soluble in water, and is reduced to the metallic state with charcoal in a tube, on the application, however, of a higher heat than is required for arsenious acid.§ When in solution,

* American Journal of Medical Sciences, vol. xxvi. p. 497. This case occurred in Germany, and is related by Dr. Spaeth, of Esslingen. See also a similar case by Dr. Fiedler. (London Med. Gazette, vol. xxxi. p. 270.)

† Dr. Lewinstein, from a German journal, quoted in Chemist, vol. iv. p. 41.

‡ London Med. Gazette, vol. xlv. p. 374.

§ Two cases of poisoning by arseniate of soda are reported. (Amer. Journ. Med. Sci., October, 1852; Wharton and Stillé's Med. Jurisprudence, p. 454.) Also cases in Paris, in which arseniate of soda was mistaken for tartrate of soda.

nitrate of silver throws down a *brick-red* precipitate, sulphate of copper a pale bluish-white one, while sulphuretted hydrogen, preceded by acidulation with muriatic acid, and transmitted for some time, gives the yellow sulphuret. It will at first, according to Orfila, produce only a whitish and slightly yellow precipitate.

Sulphurets of arsenic. The native sulphurets (orpiment and realgar) were administered by Hoffman and Renault to dogs and other animals, without occasioning the slightest derangement. Smith and Orfila have, however, found them poisonous. The latter applied these substances to the cellular tissue of dogs, and also introduced them into the stomach; and in each case, when doses from 50 to 120 grains were used, the animals died in between 40 and 60 hours. On dissection, marks of inflammation and ulceration were seen on the mucous membrane of the stomach, and the interior of the ventricles of the heart presented several red spots.*

Artificial orpiment is, however, more actively poisonous, and for the reason that it is a mixture of sulphuret of arsenic and arsenious acid.† The paint called *king's yellow* is also decidedly noxious. This is an impure sulphuret, consisting, according to an analysis of Dr. Christison, of the sulphuret, caustic lime and free sulphur.‡

Although the native sulphurets are evidently less poisonous than the artificial, yet Decourdemanche has indicated another cause why the former are also more active under certain circumstances. When boiled with water, it decomposes them, sulphuretted hydrogen is evolved, and the white oxide of arsenic remains in solution. This change will even take place in the cold, though more slowly; and is much accelerated by the presence of animal or vegetable principles in the water.§

* Lancet, vol. x. p. 276, from Journal de Chimie, 1826.

† Guibourt, Edinburgh New Philosophical Journal, vol. i. p. 319.

‡ Christison, p. 262.

§ Edinburgh Medical and Surgical Journal, vol. xxviii. p. 228. Hence Orfila is of opinion that, in the case of a person poisoned with the sulphuret, oxide of arsenic may be discovered in the intestinal canal. (Leçons, 3d ed., vol. iii. p. 179.)

There are some interesting cases of poisoning with the sulphuret, which may be here stated :—

A lady aged sixty, and named Mrs. Smith, the owner of some property, went to lodge with Mrs. Burdock, in Bristol, (England.) She shortly became unwell, from a cold, and some gruel was given to her by her landlady. In half an hour she was taken very ill, violent pain ensued, and she spat thick blood in the pot. No medical assistance was summoned, and she died in about an hour, and was privately interred.

Her relations, who had not been apprised of her decease, presently became aware of it. Suspicions were excited, and at the end of fourteen months after her burial, in December, 1834, a warrant was issued for the disinterment and examination of the body. There was some water in the coffin, but the dress was tolerably firm. The face of the corpse was shrunken, and of a dingy-yellow color; the nose depressed, and the orbits sunk. The abdomen was considerably flattened, but the thorax maintained its usual convexity. The integuments of these were converted into adipocire. On opening the abdomen, the alimentary canal was found in a remarkable state of preservation. The intestines contained neither fluid nor gas; and some of their convolutions were matted together. The diaphragm was firm; the lungs and heart shrunk in size, of a dark-blue color; and the latter contained some dark-colored fluid, which was evidently decomposed blood.

On separating the duodenum from the small intestines, its mucous membrane was observed to be covered with a large quantity of a viscid yellow substance. This was carefully removed. The mucous membrane of the mouth and gullet was decomposed; the stomach and intestines, however, were firm, and appeared as little affected as "if the person had been dead only a few days in cold weather." Their odor was, according to Dr. Symonds, altogether peculiar, removed equally from their smell when examined in the fresh body, and from that of putrefaction. It was most persistent, so that he and others had great trouble in freeing their hands and clothes from it. The lining membrane of these viscera was smeared with a large quantity of an unctuous yellow substance, which was readily scraped off, and it was seen to be more firm in the

parts where the yellow matter was in contact. The large intestines bore the marks of inflammation, being more or less red in various points. The soft parts of the brain were decomposed.

Mr. Herepath, Lecturer on Chemistry at the Bristol Medical School, took a portion of the matter found in the stomach, applied heat to drive off moisture, and then mixed it with a little carbonate of soda and charcoal, and introduced the whole into a glass tube. On applying heat, metallic arsenic was condensed. The part of the tube that contained the metallic crust was then cut off, heat was freely applied, and, it being now in contact with the atmosphere, arsenious acid was produced. A portion of this was now dissolved in a small quantity of water, and the solution divided into three parts. To these, the ammoniated nitrate of silver, the ammoniated sulphate of copper, and sulphuretted hydrogen, were respectively added, and they each gave their characteristic results.

Subsequently he treated some yellow-tinged matter washed from the stomach as follows: Thirteen grains were boiled in nitro-muriatic acid, which decomposed the animal matter, dissolved the phosphates and the arsenic, and converted the sulphur into sulphuric acid. Ammonia being added in sufficient quantity to supersaturate this acid, the mixture was then acidulated with acetic acid, and filtered. A stream of sulphuretted hydrogen passed over it precipitated four grains of sulphuret of arsenic.

It is probable that nearly a drachm of the sulphuret was present in the alimentary canal of the deceased. When we recollect that some was evacuated by vomiting, and also that the accused had given some to Mrs. Smith on the day previous to her death, certainly a sufficient quantity to produce the result was accounted for.

This anatomical and chemical examination—and which cannot be too highly commended, and confers the highest credit on Mr. Herepath, Mr. Kelson, and Drs. Riley and Symonds—led to the apprehension, trial, conviction, and execution of Mrs. Burdock. It appears that she endeavored to purchase arsenic of a druggist, but he not having any on hand, she obtained the sulphuret from him. Dr. Symonds subsequently obtained a

quantity of the same sulphuret (and which evidently contained some arsenious acid) from the druggist in question, and made experiments with it on animals. Fifteen grains injected into the stomach of a rabbit did not kill it, but two scruples employed in the same way did. Thirty-five grains killed a small dog in nine hours.*

On the 30th of June, 1829, Dr. Lepelletier was directed to disinter and examine the bodies of M. Fortier and his daughter, the former nine, and the latter three months after interment, from a suspicion that they had been poisoned. The body of the daughter, aged forty years, was in a state of complete putrefaction, except that the abdominal viscera was scarcely affected by it. The peritoneum was sound, and the mucous membrane of the digestive canal, from the œsophagus to the rectum, was untouched by decay; but it was covered with bright-red spots, and in these a yellow matter was found. The œsophagus contained about two spoonsful of a dark fluid, similar to venous blood, and also some of the same yellow substance, while in the stomach was a yellow liquid. In several places the false membranes were found and readily detached from the lining coat.

In the body of the father, although putrefaction was still further advanced, yet the abdominal viscera were also sound, and the same marks of inflammation were seen, while several ounces of a thick, yellowish fluid were found.

In both these instances, a few experiments served to show that the yellow substance was sulphuret of arsenic.†

* Transactions Provincial Med. and Surg. Association, vol. iii. p. 432; London Medical Gazette, vol. xv. p. 516, vol. xvi. pp. 87, 121, 231; Medico-Chirurgical Review, vol. xxvi. p. 463; London Medical Quarterly Review, vol. iv. p. 390. In a communication made to the British Association, (Report of the sixth meeting, Appendix, p. 67,) Mr. Herepath states that he has satisfactorily ascertained that *realgar* (the proto-sulphuret) was administered to Mrs. Smith, although it was undoubtedly found as *orpiment* (sesquisulphuret) in the dead body. He supposes, therefore, that this change took place during putrefaction, as two agents then developed, ammonia and sulphuretted hydrogen, will convert *realgar* into *orpiment*. But to place the matter beyond all doubt, a direct experiment was made by poisoning an animal with *realgar*, which, after putrefaction, became changed, as in the case of Mrs. Smith.

† Orfila, Exhumations Juridiques, vol. ii. p. 317. Suspected case of poisoning by sulphuret of arsenic, but in which none could be found, are given in Annales d'Hygiène, vol. ii. p. 405, vol. iii. p. 381.

The usual mode of reduction with sulphuret of arsenic, is with the dry soda flux, as already mentioned. The substances are placed in a small tube, and the heat of a spirit-lamp is applied. Berzelius recommends a light charcoal impregnated with a solution of carbonate of soda by immersion in that liquid. It is afterwards dried and gently heated to redness in a covered platina crucible. The reduction is performed by placing the sulphuret in a glass tube of very small diameter, closed at one end; on this some pieces of prepared charcoal, about half an inch long, are placed. The tube above the charcoal is now drawn to a fine point. Heat is applied, first to the charcoal, and then to the sulphuret; in a short time, sulphuret of sodium is formed, and arsenic is sublimed in the drawn-out part of the tube.*

Dr. Christison advises that when sulphuret of arsenic is contained in organic mixtures, it be removed by adding caustic ammonia. This dissolves it, and the solution, on being acidulated with muriatic acid, will deposit the sulphuret sufficiently pure for undergoing the process of reduction.

Arseniuretted hydrogen gas. This substance has proved fatal to a distinguished chemist, the late Mr. Gehlen, of Munich. He was distilling a mixture of arsenic in powder and caustic potash, in order to observe the action of the latter on the former. Finding that the combination was taking place very slowly, he applied his nostrils several times to the flask which contained the mixture, in order to ascertain by the odor the state of the mixture. About an hour afterwards, he was seized with uninterrupted vomiting, rigor, and excessive prostration of strength; these symptoms continued for nine days, when he died, although every effort was made for his relief.†

* Journal de Pharmacie, vol. xxiv. p. 181. Runge advises for the reduction of the sulphuret, pieces of charcoal, boiled in a solution of acetate of silver, and subsequently dried and heated to redness. (Ibid., vol. xxiv. p. 143. Taufflieb reduces it by introducing a small filament of silver-leaf on a twig into the tube holding the sulphuret. By the application of heat, the sulphur leaves the arsenic and attaches itself to the silver, and metallic arsenic is condensed in the form of a brilliant, black ring, at some distance from the heated part. (Ibid., vol. xx. p. 393.)

† Male, p. 176.

Mr. Bullocke, a lecturer on chemistry, was also destroyed by it in December, 1836. "The gas-jar not having as much water in it as he supposed, and the atmospheric air above the water diluting the gas, he inconsiderately applied his mouth to draw up the atmospheric air, while the process of generation was going on, and thus inhaled some of the gas." It affected the whole nervous system and ultimately the lungs. He died in ten days.*

A third case has excited still greater attention: Mr. Brittan, a druggist and chemist of some eminence in Dublin, while engaged in preparing a work on chemical manipulation, inhaled by way of experiment, a quantity of hydrogen gas. The quantity taken in, at two different periods, was about 150 cubic inches. Immediately after inhaling the last portion, he was seized with giddiness and faintness, followed by shivering, a discharge from the bowels, and about two ounces of blood, without pain, from the urethra. Pain in the extremities, followed by numbness, succeeded; and these, again, by constant vomiting for several hours. Medical aid was now called, and as he complained of pain at the epigastrium when pressed, leeches were applied and other appropriate remedies used. The next day vomiting recurred; the bowels had been moved, but no urine was passed. Hiccough also came on. The symptoms on the day succeeding were mitigated, but no urine, nor was there any secretion of it, except a little depositing blood, during the remainder of his life. Somnolency ensued, and he finally died in 148 hours after inhaling the supposed hydrogen gas. The stomach was empty, with two reddish spots in the great curvature, and its mucous membrane equally detached. The kidneys were of a deep-indigo color, the left very large, resembling the spleen; the right firm and natural. The bladder was empty and natural.

Dr. O'Rielly, who had been in attendance, was led to inquire whether the ingredients employed in making the hydrogen were pure, and therefore took some of the sulphuric acid and zinc used by Mr. Brittan, and having added them, caused the evolution of the gas. *He obtained a large*

* London Medical Gazette, vol. xix. p. 591.

quantity of arsenious acid and metallic stains. Fluid tests also indicated arsenic; and lastly, that metal was obtained by reduction.

It should also be stated that a portion of reddish-brown fluid effused within the pleura gave proof that it held arsenic in solution.

The next point to be settled was, whether the zinc or the sulphuric acid contained the poison. After obtaining not less than six specimens of sulphuric acid from different druggists in Dublin, he found all to contain more or less arsenic, and by using iron filings in the place of zinc, he found that arsenic was still formed. This sulphuric acid appears all to have been made from iron pyrites.

From experiments and calculation, Dr. O'Reilly concludes that the amount of arsenious acid inhaled by Mr. Brittan was about twelve grains.*

There is no doubt but that the arsenical candles, about which so much has been said in England, may prove injurious by the production of this gas.

It has been suggested that this gas, on being inspired, is decomposed in the lungs, the hydrogen uniting with the carbonic acid, while the arsenic is deposited in the bronchiæ.†

Iodide of arsenic is a preparation somewhat in use, and may hence become the cause of poisoning. According to Dr. A. T. Thomson, it is a most virulent poison in large doses. When given to dogs in whom the œsophagus is tied, it inflamed the tissues to which it was applied, and softened and gelatinized the mucous membrane of the stomach. It sometimes, also, caused ulceration. When applied to mucous or serous surfaces, or an ulcer or wound, it is absorbed and exerts a deleterious influence on the nervous centres and the heart.

The presence of iodine can, in these cases, be generally detected in the urine, bile, saliva, and blood. In testing the two former, Dr. Thomson mixed with the fluid some cold muci-

* Edinburgh Med. and Surg. Journal, vol. lvii. p. 521. From Dublin Journal of Medical Science.

† London Medical Repository, vol. iv. p. 331; Brande's Journal, vol. iii. p. 208.

lage of starch in a *cylindrical* vessel, and then poured over the mixture *gaseous* chlorine. Sulphuretted hydrogen will throw down the arsenic, and whenever the iodide of arsenic is present, either solid or in solution, the sulphuretted hydrogen and chlorine should both be used.*

Arsenic, in its metallic state, oxidizes so readily that it would be extremely hazardous to pronounce it innoxious. Renault has, however, given two drachms of mispickel (an alloy of arsenic and iron) to animals, without any injurious effects. This fact gives us the assurance that the arsenic which is sometimes contained in tin needs not be feared, as it is in the metallic state.†

MERCURY.

The most important compound of this metal, in its relation to legal medicine, is

CORROSIVE SUBLIMATE. Like arsenic, this substance is poisonous, whether internally or externally applied, but a larger quantity is required to produce deleterious effects.

* *Lancet*, N. S., vol. xxiii. p. 176. Dr. Thomson's paper, read before the British Association in 1838.

† *Edinburgh Medical and Surgical Journal*, vol. vii. p. 90. There are two curious cases, which it may be somewhat difficult to arrange, but which I may mention in a note. One occurred in France, and its history was communicated to the Academy of Medicine: A manufacturer of the blue pigment used in painting china was engaged with his servant in boiling a mixture of nitric acid, cobalt, and arsenic. On a sudden, the matrass burst, and the room was filled with the fumes. The servant escaped, but the master was knocked down, and lay insensible for some time. He died after eight days' intense suffering, his body having become enormously swollen. The servant was attacked with similar swelling of the abdomen, but was relieved by purgatives and the warm bath. (*Medico-Chirurgical Review*, vol. xxiii. p. 504.) The other is mentioned by Dr. Elliotson: A whole family were seized with nausea and vomiting, and all had watery eyes. Their pulses were rapid, and, indeed, there was a general inflammatory state of the system in all. As none of the neighbors were similarly affected, he suspected from the symptoms that arsenic might be the cause; and, on inquiry, found that the persons who had previously occupied the premises were mixers of colors, and had deposited, before leaving, in the kitchen and garden, large quantities of arsenite of copper. The situation of the house was damp; and it was the opinion of the chemist that the contact of water decomposed the arsenite, and produced arseniuretted hydrogen. (*Lancet*, N. S., vol. x. p. 133.)

Internally, (a.) Its exhibition by the mouth. If corrosive sublimate be exhibited in considerable doses, and especially if its use is too long continued, it causes colic and vomiting. These are succeeded by affections of the salivary glands, ptyalism, swelling of the tongue and gums, destruction of the teeth, and swelling of the face and head. Cardialgia, diarrhoea, dysentery, phthisis pulmonalis, tremors of the limbs, paralysis, or even death, have been the consequence of persisting in such a course for an improper space of time.*

Dreadful as this catalogue of ills may appear, it is usually aggravated when we are called to view a patient *poisoned* by this mineral. The dose being larger, the effects are more immediate. We may state the *ordinary* symptoms in such cases to be the following: "An acrid, astringent, metallic taste in the mouth; a sensation of stricture and burning heat in the throat; anxiety, and rending pains in the stomach and in the whole of the intestinal canal; nausea; frequent vomiting of a fluid which is sometimes bloody, and accompanied with violent efforts; diarrhoea, sometimes dysentery; pulse small, tight, and frequent; faintness, general debility, difficulty of breathing, cold sweats, cramps in all the limbs, general insensibility, convulsions, and death."†

As discriminative of the effects of this substance from those of arsenic, Dr. Christison observes that its symptoms begin much sooner; the irritation in the throat and stomach sometimes, indeed, commencing during the very act of swallowing, or the first five minutes; that its taste is more unequivocal and strong; that the sense of acridity along the throat and in the stomach is much more severe, and that the countenance is usually flushed and swollen.

In addition to these, it has been noticed by some observers that there is a great diminution in the secretion of urine. Dr. Henry, of Manchester, in a case where death followed in four days, remarked that no urine was voided after the third day, and on introducing the catheter, the bladder was found empty.‡ In the cases related by Mr. Valentine, where a mother poisoned

* Orfila's Toxicology, vol. i. p. 47.

† Ibid., vol. i. p. 60.

‡ Edinburgh Medical and Surgical Journal, vol. vii. p. 151.

herself and four children, the same observation was made. One child died in twelve hours after taking the poison, and during this period no urine was secreted; another in twenty-four hours, and voided a very small quantity. The third died in thirty-two hours, and secreted none; while the mother, who lived seventy hours, only passed a very little.*

It must also be remarked that the pain and stricture in the pharynx and œsophagus are sometimes so severe as to cause the greatest distress in swallowing even the mildest fluids, and in one instance they were so excessive as for some hours to destroy the power of speech.† Bloody vomiting is not uncommon, and coagulable lymph has been found in the matter purged, mixed with clots of blood.‡ In fatal cases the pain at the scrobiculus cordis continues without intermission, and in those who recover, it is among the last symptoms that disappear. In Dr. Henry's patient, a complete paralysis of the upper and lower extremities occurred a few hours before death.

According to Dr. Christison, the ordinary duration of fatal cases is from twenty-four to thirty-six hours. There are but a few where life has been prolonged beyond this. The most protracted, with the ordinary symptoms of irritation, is that related by Dr. Venables. A female took this poison to procure abortion. She was seized with vomiting and purging, tenesmus, a muco-sanguineous discharge from the bowels, and total suppression of urine, while blood was contained in the

* *Ibid.*, vol. xiv. p. 463. The only one (a child) that recovered, having taken a small quantity, voided no urine in three days. Dr. Christison (p. 359) adduces several parallel instances.

See also Mr. Reid's case, in *Medico-Chirurgical Review*, vol. xxxvi. p. 615. The patient survived five days, yet voided no urine during that time. Alfred S. Taylor's case, in *Guy's Hospital Reports*, second series, vol. ii. p. 24; no urine during four days.

† Case by Mr. Anderson, *Edinburgh Medical and Surgical Journal*, vol. xiv. p. 474. On the contrary, a case is related by Mr. Saunders, where the patient lived nine days, and during that period experienced little pain, and only felt some soreness after the sixth day. Hiccough was present during part of his illness. (*London Medical Repository*, vol. ii. p. 458.)

‡ Valentine, *ut antea*. In two of these cases coma and insensibility of the pupils were present for some time before death.

matter vomited. Still there was no fetor or salivation. She died on the eighth day.*

The most rapid cases on record are one of Mr. Valentine's, (twelve hours,) with that of Mr. Illingworth, where the individual, an adult, was last seen alive at 11½ P.M., and was found dead in his bed at 7½ A.M., with his face and extremities cold.† Mr. Taylor, (on Poisons, p. 404,) however, mentions a case communicated to him by Mr. Welch, in which the patient (a man intemperate and a suicide) died in *half an hour*.

* London Medical Gazette, vol. viii. p. 616. I have noticed the following cases, in addition to those already quoted :—

Houlston on Poisons, p. 81. An adult took six drachms in solution : recovered.

Coxe's Medical Museum, vol. ii. p. 180. Case by Dr. Budd. A female took an ounce; she had the usual severe symptoms, but recovered.

American Journal of Medical Sciences, vol. vi. p. 540. Case by Dr. Hort. Recovered.

Edinburgh Medical and Surgical Journal, vol. xv. p. 510. Case by Mr. Thomas. Recovered.

Ibid. Case by Mr. Blacklock. A man, aged fifty, took a drachm, dissolved in three gills of water, through mistake. His symptoms were not peculiar. There were present bloody vomiting and purging, succeeded by bilious vomiting and purging; and during the whole of his illness he suffered under violent and incessant hiccough. The urine was suppressed, and there was a numbness of the arms and legs. He died on the seventh day. (Vol. xxxvi. p. 92.)

Ibid., vol. xliii. p. 253. Case by Ollivier and Barruel, of three children, poisoned through carelessness, at Paris. The oldest, aged seven, took eighteen grains, and died in three hours; the youngest, about two years old, took six grains, and died in eleven hours. The mistake was discovered in two hours, and antidotes were given; but the youngest would not take them. The second, aged three and a half years, took twelve grains. It apparently recovered from the immediate effects; but in a few days diarrhoea and other symptoms of gastroenteritis came on, and death followed on the twenty-third day.

The same cases are given in the Medico-Chirurgical Review, vol. xxvi. p. 515.

Guy's Hospital Reports, second series, vol. ii. p. 24. Case by Alfred S. Taylor. A man, aged thirty-eight, took two drachms; he died in four days, although the usual antidotes were given.

Transactions New York State Med. Society, 1850. Case by Dr. McCready.

Many other instances, under the different varieties, are cited by Christison and Orfila.

† London Medical Gazette, vol. xxxi. p. 556.

To this variety of poisoning Dr. Christison adds a second, which begins like the former, with irritation of the alimentary canal, but the symptoms of mercurial erythism (inflammation of the salivary glands and parts adjoining) supervene. These usually occur on the second day, and the fatal termination is generally delayed beyond the period mentioned above.*

Mr. Murray relates of a Hindoo, who, by accident, swallowed about six or eight grains of corrosive sublimate in solution. Vomiting followed almost immediately, and in two days thereafter diarrhoea. Ptyalism soon supervened, which lasted three or four days, and it was about the expiration of this period that he came under medical treatment. He complained of debility, but the diarrhoea had ceased and the ptyalism was nearly gone. To these succeeded repeated attacks of bleeding from the nose, a tendency to dozing, and frequent tremors, but no abdominal tenderness or vomiting. He died on the twelfth day. The mucous membrane of the stomach and duodenum was found to be much thickened, of an intensely red punctiform appearance, and smeared with a viscid adherent mucus. The kidneys and bladder were healthy; the latter containing a good deal of urine. The heart was soft, flaccid and atrophied.†

Besides these, there are many other instances in which the patient escapes the immediate danger, but is still liable to the chronic effects of the metal, as salivation and its consequences. The constitution often breaks down after a time under the irritation.

(b.) *By injection into the anus.* We have reason to believe, from the result of experiments on animals, that the effects of the poison administered in this way would be similar to the former. The only case on record that I have noticed, is a complex one, from the extraordinary combination of poisons

* Dr. Christison doubts whether salivation has ever occurred sooner than the second day. There is a *probable* case of poisoning by corrosive sublimate, related by Mr. Wool, in *Edinburgh Medical and Surgical Journal*, vol. li. p. 114, where the salivation commenced after seven hours. The early history is, however, obscure, and the patient had been laboring under the venereal. See *ibid.*, liii. p. 404.

† *Transactions Medical and Physical Society of Bombay*, vol. i. p. 322.

given to destroy life. As, however, the corrosive sublimate appears to have been the immediate agent of death, I shall mention it in this place:—

Sir Thomas Overbury was poisoned in the year 1613, in the Tower of London, at the instigation of the Earl and Countess of Somerset. The agents were punished, but the principals escaped. From the confession of Franklin, the apothecary, it appears that the countess wished to procure the strongest possible poisons for Sir Thomas. He accordingly bought seven—*aqua fortis*, *white arsenic*, *mercury*, *powder of diamonds*, *lapis costius*, *great spiders*, *cantharides*. All these were given at different times. Sir Thomas never ate white salt, but there was arsenic put into it; and Mrs. Turner, when two partridges were sent to him, and water and onions were the sauce, put in cantharides instead of pepper. Indeed, said Franklin, he seldom ate anything in which there was not poison. Richard Weston, while acting as keeper to Overbury, procured a poison of a green and yellow color, (rosalgar,) and mixed it with the broth. He procured white arsenic and mixed it with his food; and, in addition, mingled some corrosive sublimate in tarts and jellies. *The sublimate was also dissolved in a clyster, and administered to the prisoner.* This produced, according to the confession of Weston, sixty stools, together with vomiting. Sir Thomas died the next day.*

EXTERNALLY. *Applied to a wound or ulcer, or to the skin.* Orfila quotes several cases, illustrating the dangerous, and indeed fatal effects of this mode of application. I shall only cite one from Pibrac: “A strong, robust woman, aged forty-nine years, of a good temperament, having an ulcerated cancer of the breast, was intrusted to the care of an empiric, who employed upon her his white powder, externally applied; it was corrosive sublimate. The patient was in great pain after the application; the pains of the cancer greatly increased, and in the space of a few hours became intolerable. A crowd of symptoms occurred at once: oppression, nausea, vomitings, which extended even to blood, and convulsive motions the most violent. In fine, she suffered in every part of her body

* Hargrave's State Trials, vol. i. pp. 323, 345.

a dreadful torture, from which she was not delivered till the next morning by a horrible death.”*

A solution of corrosive sublimate in alcohol, applied to the skin, has produced, within a few hours, violent pains of the stomach, accompanied with sickness, vomiting and diarrhoea. The debility that follows is of the most alarming kind. In one instance, the stools consisted of blood and mucus; and it is evident that if the use of this noxious substance had been continued, fatal consequences would have ensued. Salivation seems to be a constant effect from this mode of application.†

Appearances on dissection. In the case of Dr. Henry, already quoted, the external appearance of the stomach and intestines was perfectly natural. About two ounces of a thick, yellowish, ropy fluid, were found in the stomach, which was but moderately distended with air. On its inner surface, numerous dark-red spots, indicating inflammation of the villous coat, were observable; they extended through the whole length of the smaller curvature, and occupied the greater part of the fundus, but did not appear in the lower portion of the large curvature. No abrasion of the villous coat was perceptible. The inner coat of the duodenum, as far as the middle of its length, presented the same appearance of inflammation. The lower part

* Orfila's Toxicology, vol. i. p. 59.

† Cases of this nature are related by Dr. Anderson, (Edinburgh Medical and Surgical Journal, vol. vii. p. 437,) and Mr. Robertson, (ditto, vol. viii. p. 195;) and by Dr. Cloquet of himself, communicated to Orfila, (vol. ii. p. 462.) In this latter, vomitings, gripings, and tenesmus were induced, barely from plunging his hands several times in a concentrated solution, for the purpose of taking out some anatomical preparations, and neglecting afterwards to wash them.

Two dreadful cases of suffering and death, by Mr. Ward, (London Med. Gazette, vol. iii. p. 666,) in brothers, who each rubbed in an ounce of corrosive sublimate mixed with hog's lard, on the lower part of the abdomen. Sensations of roasting alive followed in each, and one went and laid himself in a stream of water for relief. Nausea, pain, constriction about the fauces, suppression of urine, discharge of blood from the stomach, and pyalism followed. Both died; and in the one who survived longest, mortification occurred previous to death.

Other fatal cases are mentioned by Dr. Kimball, in Western Journal of Medical and Physical Science, vol. iv. p. 483; by Dr. Senter, in Transactions of College of Physicians of Philadelphia, vol. i. p. 247; and in the Chemist, vol. v. p. 87, from the Gazette des Hôpitaux.

of the œsophagus, for about three inches above the cardia, was slightly inflamed; but higher up, it was of a natural color. The heart, lungs, liver, and spleen were sound. The gall-bladder was emptier than usual. The left kidney was of a looser texture than natural, and a small abscess was discovered in it filled with pus. *The bladder was empty and exceedingly contracted.*

In each of his four cases, Mr. Valentine found the stomach greatly diseased. Black circular patches, about three inches in diameter, were observed, and from them an extensive inflammation of the inner coat diverged in all directions. "In the child which died first, the texture was totally destroyed through all the coats, as far as the circular patch extended; and on washing off the destroyed parts, only the peritoneal covering of that part of the organ was left. It cannot be better compared," he observes, "than to a piece of leather *burnt with a red-hot coal.*" The intestines were highly inflamed. The gall-bladder, in every case, was greatly distended with bile; the peritoneum generally inflamed, as were also the mesentery and omentum. In one instance, the kidneys were inflamed. *In all, the urinary bladder was much contracted; in the mother, it was of the size of a walnut, and in one of the children, no larger than a marble.*

The mouth, throat, and gullet are also frequently inflamed.* A singular appearance sometimes observed in the former, is a shriveling of the tongue, with great enlargement of the papillæ at its root.†

The destruction of the coats of the stomach and intestines, and more particularly the colon and rectum, which is so commonly seen in fatal cases, originates, according to Dr. Christison, from two causes, corrosion and ulceration. The former is described in Mr. Valentine's cases, and also in Dr. Venables'. In this last there was a patch on the under surface of the stomach as large as two crown-pieces, and of a very dark-olive color, besides general erosion of the villous coat. If life is pro-

* In one of Ollivier's cases, (the oldest,) the mucous membrane of the œsophagus was easily detached in curling shreds.

† Christison, p. 387.

longed, the disorganized matter sloughs off, leaving an ulcerated cavity. Ulceration is either a consequence of inflammation, which of course is an almost constant morbid appearance, or it results from corrosion. Often large, black, gangrenous ulcers are seen both in the stomach and the lower intestines; the small ones, I believe, generally escape. Inflammation of the peritoneum and kidneys frequently occurs. Orfila has found that the internal membrane of the heart is sometimes inflamed and chequered with black spots. In both of Ollivier's cases the same was seen. There were ecchymosed patches on the internal surface of the left ventricle, beneath its inner membrane, which was pale and whitish.

Orfila remarks that in several instances where the quantity taken has been considerable, he has seen the tissues to which it has been applied of a slate-gray color; an appearance which he has not noticed from any other poison.*

Of course, there are cases in which inflammation alone is observed.

I have already, in a previous chapter, noticed the effects of the introduction of corrosive sublimate into the dead body. On the rectum, its chemical effects alone were visible, and no marks of vital reaction appeared.

Effect on animals. Mr. Brodie injected into the stomach of a rabbit, by means of an elastic-gum tube, six grains of corrosive sublimate, dissolved in six drachms of distilled water. No immediate symptoms followed the injection; the animal made no expression of pain, but in three minutes he became insensible, was convulsed, and in four minutes and a half from the time of the injection being made he died. On opening the thorax, the heart was found to have entirely ceased acting, and the blood in the cavities of the left side was of a scarlet color. The stomach was much distended; the pyloric and cardiac portions were separated from each other by a strong muscular contraction, which appeared to have prevented the passage of the fluid from the upper to the lower part, since the contents of the pyloric portion were firm and solid, and in every respect resembled the usual contents of the stomach, while those of the

* *Leçons*, third edition, vol. iii. p. 121.

cardiac portion consisted of the food of the animal, much diluted with fluid. In the pyloric portion, also, the mucous membrane had its natural appearance, but in the cardia it was of a dark-gray color, readily torn and peeled off, and in some parts its texture was completely destroyed, so that it appeared like a pulp, on removing which the muscular and peritoneal coats were exposed.

A similar experiment, with a scruple of corrosive sublimate, on a cat, produced death in twenty-five minutes; and on dissection, the texture of the stomach was found destroyed as in the preceding case; the mucous coat tore and separated from the muscular with great facility, and the upper part of the duodenum was similarly altered, although not in so marked a manner.

The same experiments were now performed on a dead rabbit and cat, and *precisely the same appearances were found on dissection*, except that as the middle contraction was wanting, the disorganization was not confined to the cardiac portion.

The conclusion drawn by Mr. Brodie is the following:—

“Corrosive sublimate, when taken internally in large quantities, occasions death by acting chemically on the mucous membrane of the stomach, so as to destroy its texture, the organs more immediately necessary to life being affected in consequence of their sympathy with the stomach.* He also denies the idea of the absorption of the poison in these cases. This, however, is believed by many physiologists, and at all events, is far from being a settled question.†

Corrosive sublimate has been considered as nearly innocuous to horses, and has been given in doses of several drachms without producing any apparent effects. An instance is, however, related by Dr. Reeve, where two ounces produced death in eight hours; and previous to this, there was a copious discharge of urine and feces. On dissection, no inflammation was observed in the coats of the stomach; the intestines, however were flabby and tender, and putridity had far advanced in them. The liver and kidneys were in a putrid state.‡

* Edinburgh Medical and Surgical Journal, vol. vii. p. 462.

† Ibid., vol. xi. p. 126.

‡ Edinburgh Medical and Surgical Journal, vol. v. p. 254.

In several experiments made by Dr. Bostock and others on dogs, with small doses of this mineral, vomiting and purging, with symptoms of violent pain, ensued; and after some hours, they terminated in death. In one case, on dissection, the peritoneal coat of the stomach was found inflamed, and the vessels of its internal surface were injected so as to present a general redness, but there was a very slight corrugation of the coats, and no erosion; but in another instance, where the dose had been larger, the villous coat was much corrugated and inflamed, and on that part of it which lines the small curvature, there was much blackness, which had the appearance of blood extravasated between the coats. On cutting, however, through the villous coat, there was no extravasation.*

Campbell, Smith, Gaspard, and Orfila have severally ascertained the effects of corrosive sublimate when applied to the cellular tissue or injected into a vein. In the former case, and even when in a solid state, it causes death in three or four days. The symptoms are those of dysentery; and on dissection, inflammation, and sometimes ulceration of the stomach and rectum, are observed. Some of the experimenters also found the lungs and heart inflamed, and this was particularly noticed by Gaspard, who injected the poison at once into the blood. The mucous membrane of the intestines was red, and the lungs, according to the length of time that the animal survived, showed black ecchymosed spots, some inflamed, and others either suppurated or gangrenous.†

Tests. There is some difference among chemists as to the precise solubility of corrosive sublimate. According to Thénard, it is soluble in twenty parts of temperate water, while Orfila says eleven. It dissolves in thrice its weight of boiling

* Rutter's Vindication, p. 28.

† Christison, p. 350. Dr. Roupell (Illustrations, part 2,) introduced into the stomach of a dog a drachm of corrosive sublimate, and tied the œsophagus. The animal died in four or five hours, with little outward marks of pain. On dissection, the stomach was highly vascular, and its mucous membrane of a leaden hue. The duodenum had a mixed appearance, partly red, and partly of a lead color, and its mucous membrane was thickened. All the small intestines were inflamed, and a thick white mucus thrown upon their internal coat.

water. These proportions should be remembered, as an unnecessary addition of fluid may thus be avoided.* Corrosive sublimate is soluble in alcohol and ether.†

We shall consider its tests in three states—in a solid form; in a state of solution; and when mixed with animal and vegetable fluids and solids.

In the solid state.

(a.) Expose a small quantity of the powder, without any admixture, to heat, in a coated tube; corrosive sublimate will be ascertained by its rising to the top of the tube, lining the inner surface in the form of a shining white crust, and from its peculiar crystalline form. This last, if necessary, should be examined with the microscope.

(b.) Add a solution of caustic potash to it, and it will become yellow, the peroxide being disengaged. This yellow color distinguishes it from calomel, which is also decomposed by the solution of potash, but yields a black protoxide.

(c.) Caustic ammonia produces a permanent white precipitate, while it blackens calomel.

(d.) If corrosive sublimate be let fall in minute fragments into a tube of glass, the bottom of which contains a little pure caustic potash melted by heat, one portion of the salt rises in the form of smoke, to condense itself on the sides of the tube; while another portion sinks down and takes a red color. If the heat be continued for five or six minutes, metallic mercury in the form of globules is obtained, adhering to the sides of the tube, and mixed with the corrosive sublimate that is not decomposed. If the quantity be small and difficult of detection,

* Dr. John Davy, in a paper read before the Royal Society, June 6, 1832, entitled "Some Observations on Corrosive Sublimate," states that he found it soluble in water at 57° of Fahr. in the proportion of 5.4 per cent. Alcohol at 60° dissolved half its weight, and ether about one-third its weight. (Philosophical Transactions. Abstract of the papers read from 1808 to 1830, vol. ii. p. 173.)

† Devergie states that if corrosive sublimate, in the form of fine powder, be thrown into water, a large portion will float on the surface, and it requires considerable agitation of the vessel to induce a complete precipitation. (Vol. ii. p. 666.)

dissolve the remainder of the salt, and the globules will be precipitated.

(e.) When corrosive sublimate is left for some time in a solution of protochloride (muriate) of tin, it becomes grayish black; and in no long time its place is supplied by globules of mercury, the chlorine being entirely abstracted by the protochloride, which consequently passes to the state of a bichloride. Calomel is similarly affected.

In the fluid state.

(a.) *Reduction.* Add to the solution a little of the protochloride of tin. If mercury be present, a bluish-gray or grayish-black precipitate falls down. After boiling, allow this precipitate to fall down in a proper glass tube, (see page 564,) and decant off the superincumbent fluid as far as possible. Afterwards draw off the remaining fluid by the pipette, (page 568,) pour water over it, and withdraw again, after the precipitate has once more subsided. The bottom of the tube is then cut off with a file, and the moisture which remains is driven off with a gentle heat. The powder, which is nothing else than metallic mercury, may often be now seen in running globules. If not sufficiently coalesced to determine their nature, they may be scraped together with the point of a pen-knife, or by applying heat to the tube, a ring of minute globules will be formed. Of the liquid tests Dr. Christison deems the four following the most satisfactory:—

(b.) Sulphuretted hydrogen, when transmitted in a stream through a solution of corrosive sublimate, causes a dark brownish-black precipitate, the bisulphuret of mercury. Before the blackening commences, the gas forms a whitish or yellowish precipitate.* The hydrosulphate (sulphuret) of ammonia may be alternately used, instead of the sulphuretted hydrogen.

* Professor Pfaff, of Kiel, is said to have discovered the presence of corrosive sublimate by means of this test, though it was diluted with forty thousand times its bulk of water. (Annals of Philosophy, vol. v. p. 22.) See also M. Rose on the action of sulphuretted hydrogen gas on solutions of mercury, in Philosophical Magazine and Annals, vol. v. p. 310. He observes that unless sufficient gas be added, the precipitate will be a combination of sulphuret and undecomposed protochloride of mercury.

(c.) Hydriodate of potash causes a beautiful pale-scarlet precipitate, which rapidly deepens in tint. This is the biniodide of mercury. Care is however necessary in using this test. If applied in too large a quantity, the precipitate will dissolve in the excess of the hydriodate; if too little, it will dissolve in the excess of corrosive sublimate.*

(d.) *Protochloride of tin* gives a white precipitate which, when more of the test is added, gives place to a grayish-black one. The reason of this has been already explained. Metallic mercury is finally formed. This is an extremely minute test. Dr. Bostock says that two drops of the muriate, added to a solution which contained 1-30,000th of its weight of the sublimate, caused an obvious precipitate. When diluted, so that the fluid held only 1-3,000,000th of its weight of the salt, two drops produced an immediate gray cloud, but no precipitate was thrown down.†

(e.) Nitrate of silver causes a heavy white precipitate, the chloride of silver, which darkens on exposure to light.

Other tests have been enumerated by various writers.

(f.) Lime-water, in small quantity, precipitates the solution of an orange-yellow color, but if increased, the precipitate becomes red. In still greater quantity, "the precipitate is transformed into an oxide, at maximum, of a beautiful yellow."

(g.) A solution of saturated carbonate of potash (salt of tartar) produces a deep brick-colored precipitate. Carbonate of soda has the same effect.

(h.) The caustic alcoholized potash, poured in small quantity on a saturated solution, forms a yellowish-red precipitate, but if, on the contrary, the potash in excess be poured on it, the precipitate will be a beautiful yellow. The precipitate, both in this experiment and in experiment *g*, on being dried and exposed to heat in a glass tube, will give out metallic mercury.

If, however, the solution of corrosive sublimate is very

* A strong solution of iodide of potassium added to a minute portion of any of the salts of mercury on a clean surface of copper precipitates metallic mercury, as a silvery stain on the copper. (Pharm. Journal, February, 1852.)

† Edinburgh Medical and Surgical Journal, vol. v. p. 14.

much diluted, the caustic potash will throw down a white precipitate.*

(i.) A solution of pure ammonia produces a permanent white precipitate. On the application of heat it becomes yellow. Although this is a delicate test, yet it is not a certain one, as ammonia throws down a white precipitate in other metallic solutions.

(k.) The triple prussiate (ferrocyanate) of potash gives a white precipitate, which in a short time becomes yellow, and afterwards passes into a clear Prussian blue. All these changes of color are generally produced within thirty-six hours.

(l.) If a perfectly clean plate of copper be plunged into a solution of corrosive sublimate, and left there for an hour or two, it will become tarnished; but on rubbing it with a piece of paper, it assumes a white, shining, and silvery appearance, owing to a coating of metallic mercury.† The same effect will be produced if the corrosive sublimate be dropped on it, or if any of the precipitates obtained in experiments *f*, *g*, *h*, *i*, and *k*, be rubbed over it. This effect is now explained as a galvanic action, and a piece of gold, clasped by a zinc wire and immersed in the sublimate solution, was obviously whitened in

* The distinct effects produced by lime-water and pure potash, on calomel and corrosive sublimate, are well shown in an analysis performed by Messrs. Tyson and Fisher, at Baltimore, in May, 1835. A valuable horse was believed to be poisoned, but a grain only of the supposed matter was sent to them. They proved first, by sulphuretted hydrogen, by hydriodate of potash, and by the galvanic circle, that the substance was mercury. In order to ascertain its exact nature, they placed a portion of the powder in a tube, and applied heat. The whole was sublimed in a beautiful white powder. Liquid potash added to this gave a black precipitate, and lime-water also a brownish-black one—in both, the black oxide of mercury; and thus proving that the suspected powder was calomel. (*Philadelphia Journal of Pharmacy*, vol. vii. p. 105.)

† Vogel, in noticing this test, observes that a plate of copper immersed as above, takes a grayish-black color, and after some time, a white powder is deposited, consisting of *calomel*, mixed with some globules of mercury. Still, on rubbing the copper plate, the shining, silvery appearance will be produced. But when a plate of copper is plunged in a solution either of proto or dento nitrate of mercury, the mercury is reduced in a metallic state. (*Journal de Pharmacie*, vol. xxii. p. 548.)

an hour, although the solution in question only contained 1-2400th of its weight of the salt.

(m.) The following elegant test was proposed by Mr. Sylvester, and improved by Dr. Paris. It is an application of galvanic electricity. Drop a small quantity of the suspected solution on a polished plate of gold, and then touch the gold, through the solution, with the point of a small iron wire or a key. As soon as the galvanic circuit is completed, if corrosive sublimate be present, the gold will become silvery white in consequence of the formation of the amalgam.* Instead of a ring or plate of gold, Dr. Traill employs a common card, covered with copal varnish, and on which, when still wet, a sheet of gold leaf is laid. In a short time the leaf adheres so firmly, that it is not removable by moisture, and the card thus prepared will answer for numerous experiments.†

(n.) Professor Traill, of Edinburgh, wraps a gold leaf round a slip of zinc, and immerses it into the suspected liquid, slightly acidulated. The mercury is precipitated, and scraping off the gold and the tarnished surface of zinc, he introduces them into a small tube. The heat of a spirit-lamp is sufficient to produce a ring of brilliant metallic globules.‡

(o.) A solution of albumen causes a white precipitate, which is soluble in a considerable excess of the reagent. "The precipitate is a compound of calomel and albumen—a chloride of albumen and mercury."§

* Nicholson's Journal, No. 154; Paris' Medical Jurisprudence, vol. ii. p. 269. In the case of Mary Bateman, in 1809, Mr. Chorley, a surgeon, immersed a penknife in the solution, and by rubbing it, numerous globules of mercury were produced, and the knife at the same time was blackened. Here, says Dr. Paris, the steel knife decomposed the corrosive sublimate, formed chloride of iron, and the mercury, unable to amalgamate, appeared in globules. (Ibid., vol. ii. p. 270.)

A gold ring, armed with tin-foil, immersed in the suspected solution, and to which a drop of muriatic acid is added, has been recommended by Smithson, and followed by Nicole, to reduce the sublimate. (North American Medical and Surgical Journal, vol. i. p. 468.) But Orfila has shown the fallacy of this, in proving that the gold will be whitened by the action of the muriatic acid on the tin alone, without requiring the addition of mercury. (Brande's Journal, N. S., vol. vi. p. 183; Annales d'Hygiène, vol. i. p. 559.)

† Edinburgh Medical and Surgical Journal vol. 1. p. 172.

‡ Outlines of Lectures on Medical Jurisprudence, p. 47.

§ This is the opinion of Orfila, as will be noticed hereafter, in cases cited

The minuteness of the above tests is thus illustrated by Devergie:—

Ferrocyanate of potash will detect corrosive sublimate dissolved in 1500 times its weight of water.

Lime-water	4,000 times.
Potash	7,000 “
Subcarbonate of potash.....	7,000 “
Hydriodate of potash.....	8,000 “
Ammonia	36,000 “
Hydrosulphate of ammonia	60,000 “
Sulphuretted hydrogen.....	60,000 “
Protochloride of tin.....	80,000 “
The pile of Smithson.....	80,000* “

The next point of importance is, whether any substances which by possibility may be present in the stomach, or any of the human fluids, will change the nature of the poison, or will alter the operation of the above tests? Orfila has made this the subject of notice.

Corrosive sublimate, according to him, is decomposed sooner or later, and converted into the submuriate, by most vegetable substances, distilled waters, extracts, oils, syrups, honey, and gums.† Muriatic acid gas is set at liberty, and calomel will be precipitated, with a portion of the vegetable matter, which has undergone some change. A decoction of tea throws down instantly a yellowish-gray precipitate in flakes, which becomes pulverulent, and of a violet color, by desiccation, while at the same time, if the water be much loaded with sugar, no altera-

from him. Chantourelle, however, considers it as a compound of albumen and corrosive sublimate; and the recent experiments of Lassaigne are to the same effect. This last considers the compound to consist of two atoms of albumen, and one of the bichloride—the albumen being in the state which Chevreul has called *soluble*, to distinguish it from *coagulated* albumen, which is insoluble in water. The compound is soluble in common salt; and the practical inference hence is, if whites of eggs have been employed, to give an emetic very soon thereafter, lest the salt, which is always more or less introduced with food, promote the solution of the compound. (London and Edinburgh Philosophical Magazine, vol. x. p. 420; London Medical Gaz., vol. xx. p. 662.)

* Devergie, vol. ii. p. 670.

† According to Fabian, the mucilage of quince-seed and that of salop decompose corrosive sublimate instantaneously. (British and Foreign Med. Review, vol. viii. p. 361.)

tion takes place until after several days; and alcohol produces no effect for the space of three or four months.

The action of albumen on a solution of corrosive sublimate deserves particular notice. If a considerable quantity of the latter is poured on the former, a white flaky precipitate is formed, which, on being dried, is brittle, semi-transparent, of a yellowish color, and insoluble in water. On being submitted to heat in a glass tube, the products are principally charcoal, metallic mercury volatilized and adhering to the sides of the tube, and muriatic acid. Small quantities of corrosive sublimate produce milkiness, and the slow deposition of a precipitate. Gelatine causes similar change and decomposition as albumen. Osmazone gives a reddish-yellow precipitate, and bile a yellow one, inclining to red. A concentrated solution of corrosive sublimate, brought in contact with a large quantity of milk, produced no visible change; but when seven parts of the solution and one of milk were united, a white coagulum instantly formed, which collected together, and over it floated a liquor extremely clear. Ordinary soap mixed with it, in the proportion of one to six, produced a white precipitate. Fibrin or flesh, on being immersed in a solution of corrosive sublimate, loses its solidity and becomes friable.*

The experiments of Professor Taddei, of Florence, have also shown that gluten possesses the power, in a high degree, of decomposing corrosive sublimate. If the salt in solution be mixed with the gluten of wheat, in the proportion of four times its weight, the water will be found no longer to contain any mercury, while the gluten becomes whitish, brittle, hard, and not prone to putrefaction. The protochloride of mercury and gluten is formed.†

There is strong reason to doubt, from the examination of

* Orfila's Toxicology, vol. i. pp. 37 to 46.

† In confirmation of this, it may be added that on the trial of Michael Whiting, for administering corrosive sublimate to his brother-in-law, in dumplings, the housekeeper deposed that she could scarcely make the flour into dumplings with milk; they broke and crumbled into little pieces. And another witness said that the unboiled dumplings were more like glazier's putty than paste, though not greasy. Dr. Paris confirmed these results by his own experiments. (Paris' Medical Jurisprudence, vol. ii. p. 265.)

subsequent experimenters, whether the result of decomposition is calomel. Orfila himself, in his third edition, (vol. iii. p. 301.) allows as much. The new substance formed is probably an oxide of mercury.*

"In all these compounds thus formed, the powder may be boiled in a solution of caustic potash. The organized matter is dissolved; a heavy, grayish-black powder is formed, which is the protoxide of mercury;" and this, on the application of heat, will form running quicksilver. "*As the potash thus separates the mercury in the form of protoxide, it follows that it existed in the compound in the form of protochloride.*"†

In organic mixtures.

1. *Dr. Christison's process.* Divide all the soft solids into small fragments, and boil the mass in distilled water. Filter a small portion, and to this add the protochloride of tin.‡ If it causes a pretty deep ash-gray or grayish-black color, take the whole of the remaining fluid unfiltered, and agitate it for a few minutes with about a fourth part of its volume of sulphuric ether. This abstracts the salt from its aqueous solution. After being left at rest for a few minutes, the ethereal solution rises to the surface, and may then be removed by the pipette. (See page 566.)§ It is next to be filtered, if necessary, evaporated

* Lassaigne asserts that albumen unites directly, and forms compounds which are insoluble in water, unless the albumen be in excess. He calls these compounds *Albuminates*. (American Journal of Pharmacy, vol. xii. p. 170.)

† Christison, p. 337.

‡ Dr. Bostock, in his "Experiments to ascertain how far the presence of albumen and muriatic acid interferes with the action of bichloride of mercury and protomuriate of tin upon each other," (Edinburgh Medical and Surgical Journal, vol. xxiii. p. 65,) has shown that the presence of albumen may diminish, but not very seriously, the minute powers of the tin; that when coagulated albumen is combined with the mercury, the addition of tin will still detect the poison; but not when the compound has been dissolved in hot water. The protomuriate of tin was added to this fluid, without any effect. Muriatic acid presented no obstacle, but rather aided the action of the test, by promoting the coagulation of the albumen.

§ Devergie, in a recent memoir on the detection of corrosive sublimate, objects that ether does not take up all the mercury. He tested the remain-

to dryness, and the residue treated with boiling water. The fluid thus obtained must be tested as directed in the examination of corrosive sublimate, in the fluid state: *but if the shade from the protochloride of tin is not deep*, omit the above and continue treating the mixture with that salt as long as any precipitate or coagulum is formed. Even if but a small quantity of mercury be present, it will have a slate-gray tint. Collect this, and wash and drain it on a filter, "from which it is then to be removed without being dried, and care should be taken not to tear away with it any fibres of the paper, as these would obstruct the succeeding operation." Next, boil the precipitate in a solution of caustic potash, until all the lumps disappear. If the solution be now left at rest, a heavy grayish-black powder will begin to fall down in a few seconds. This is chiefly metallic mercury, which may be distinguished by the naked eye or a magnifier. After a proper time, remove the supernatant fluid, and transfer the powder into a small glass tube, and wash it repeatedly, till the washings do not taste alkaline. The black powder should be allowed to subside for several hours. It may then be heated and sublimed as already directed.

Dr. Christison states that by this last process he has detected a quarter of a grain of corrosive sublimate, mixed with two ounces of beef, or with five ounces of new milk, or porter, or tea, made with a liberal allowance of cream and sugar. He found the tenth part of a grain in four ounces of the last mixture, *i. e.* in 19.200 times its weight.*

2. *Orfila and Lesueur's process.* In the last edition of his *Leçons*, Orfila, abandoning the one previously advised by him, strongly recommends the following:—

Add to the suspected substance, when in a state of minute divisions, as much distilled water as will cover it. Into this pass a current of liquid chlorine to excess. Filter and evaporate, and into the liquors thus concentrated introduce a small pile of gold and tin. If the most minute portion of corrosive

ing liquid with the plate of gold and tin, and found marked traces. (*Annales d'Hygiène*, vol. xi. p. 414.)

* Christison, p. 339.

sublimate be present, the gold will be whitened. He insists much on this, since the animal or vegetable substances present, when saturated with chlorine, will not decompose the corrosive sublimate.* If any uncertainty exists as to the cause of the whiteness (*for the tin may be deposited*), inclose the pile in a small glass tube, and apply heat, which will volatilize the mercury and make it appear on the surface of the glass.

3. *Devergie's process.* Treat the suspected mixture with diluted muriatic acid till all the solid matter is dissolved. Evaporate so as to expel most of the acid employed. Add water to the rest, and transmit chlorine to coagulate and remove the animal matter. Filter, boil, and concentrate. Then immerse for ten minutes a small plate of pure tin. If mercury be present, the tin will be immediately whitened. Continue this with successive plates until the whitening ceases. Dry the plates, scrape off the tarnished surface, put the scrapings in a proper tube, and heat them over a spirit-lamp. The mercury will be driven off from the amalgam, and condense in a ring of globules.†

4. *Professor Buchner's process.* Evaporate the suspected mixture to dryness, and boil the residue in nitro-muriatic acid till the decomposition of the organic matter is at an end, which is indicated by the cessation of the discharge of orange fumes. Then treat the solution with sulphuretted hydrogen gas, which occasions first a white and then a black precipitate. This precipitate is then to be collected and heated in a tube with a little carbonate of soda, previously deprived of its water of crystallization; globules of metallic mercury are sublimed.

There are several other processes that have been recom-

* Leçons, third edition, vol. iii. p. 114.

† The above is from Dr. Christison, p. 342, etc. Devergie has subsequently recommended a modification of this process. "A thin plate of gold and another of tin, a few lines broad and two or three inches long, being closely applied to each other by silk threads at the ends, and then twisted spirally; this galvanic pile is left for twenty-four or thirty-six hours in the solution previously acidulated with muriatic acid; upon which the gold is found whitened, and mercury may be obtained in globules by heating the gold in a tube." This will give indications of mercury when the corrosive sublimate forms but an 80,000th of the water. (*Annales d'Hygiène*, vol. xi. p. 432; Christison, third edition, p. 347.)

mended, to which I refer below, and will only add that advised by Dr. Traill.* He has found that, by means of the galvanic process, he could obtain not only the amalgam stain, but also metallic globules of mercury, without the trouble of previously separating the animal and vegetable matter: "All that is necessary is to slightly acidulate the suspected liquid, or pulp, with muriatic acid, and this prepares it for the test. I use a slip of thin sheet zinc, a quarter of an inch wide and two or three inches long; one end of this is coated with gold-leaf, by wetting it between the lips and wrapping it in the leaf, so as to cover about half an inch of its end. Insert this in the liquid and let it remain from half an hour to three hours, when the gold will be stained with amalgam, if any mercury were dissolved in the liquid. The zinc is to be withdrawn from the liquid, gently rinsed in distilled water, and dried on a glass plate. The remains of the gold and the tarnished portion of the zinc, are to be scraped off and introduced into a small tube, in the usual way; the heat of a spirit-lamp is then to be applied, and metallic globules of mercury will be sublimed. When there is much mercury present, the zinc, near the gold, often becomes brittle, and yields mercury by heat. On this account, I generally break the zinc so charged into small pieces, and introduce it into the tube with the gold-leaf, and sublime as before."

The changes to which I have referred, as induced by the action of various animal and vegetable substances on corrosive sublimate, should induce the analyst to be extremely careful in ascertaining exactly the nature of the new compounds, if any, that are present. Mialhe, some years since, asserted that calomel could be converted into corrosive sublimate, by exhibiting some of the latter with one or other of the alkaline chlorides. This, again, has been denied by Lepage and D'Ollégrio, and, at all events, is still very doubtful.† But, in his last edition, Orfila mentions the following: To an individual

* Dr. O'Shaughnessy, *Lancet*, N. S., vol. vii. p. 120; Dr. Venables, *London Medical Gazette*, vol. xxiii. p. 471; Dr. Traill, *Edinburgh Medical and Surgical Journal*, vol. 1. p. 172.

† *Edinburgh Medical and Surgical Journal*, vol. liv. p. 250; *London, Edinburgh, and Dublin Philosophical Magazine*, November, 1842.

laboring under gastro-encephalitis, calomel in powder was given to the amount of eight or ten grains daily. He passed by stool a notable quantity of the black sulphuret of mercury, produced, doubtless, by the disengagement of sulphuretted hydrogen. He infers that, under similar circumstances, corrosive sublimate and the other salts of mercury would be even more readily decomposed than calomel.*

The rapid progress of medico-legal analysis is strikingly seen in the history of the tests of this salt. Being soluble, and very liable to be discharged by vomiting, and, above all, being readily decomposed by many substances, it is not surprising that chemists could not discover it, even under the most favorable circumstances, in the fluid contents of the stomach. In the experiments of Dr. Bostock on dogs, the very tests which proved the presence of corrosive sublimate in the most minute quantity were unable to show its presence in the fluids of the animals which he had previously poisoned with this very substance, and they only indicated the existence of muriatic acid.† Drs. Henry and Roget examined the fluid vomited by a female who had poisoned herself, with all the tests mentioned in the chemical work of the former, but neither in this liquid, nor in that found in the stomach after death, were any traces of the poison discoverable.‡ “In vain,” says Orfila, “should we seek, in the general way, for corrosive sublimate in the liquids vomited; neither are the contents of the stomach more calculated to discover its presence. The decomposition which it has undergone, by its union with other substances, has rendered it insoluble. *It is in the solids, in the tissue itself of our organs, that it must be sought for.*” In confirmation of the latter remark, he mentions a case, in which he took a portion of the intestines of a cock, and put it in a solution of corrosive sublimate for three days. It was then boiled, dried in a capsule of porcelain, and finally calcined in a retort. Globules of mercury were soon seen condensed in its neck. The stomach of a dead rabbit,

* Leçons, third edition, vol. ii. p. 137.

† Edinburgh Medical and Surgical Journal, vol. v. p. 16.

‡ Edinburgh Medical and Surgical Journal, vol. vii. p. 150.

into which a solution of corrosive sublimate had been injected, was treated in the same way, with a similar result. Again, it is stated by Taddei, that in cases of corrosion, if the slough be examined before it is thrown off, it will yield mercury by chemical analysis.*

It is evident from these facts, that the solid parts should be examined in all criminal cases.

I will conclude this part of my subject with a brief narrative of a few of these. And the first that may be noticed is interesting, from involving the decision of a curious question connected with the action of mercurial medicines, viz., *whether ptyalism is capable of a complete intermission?*

Jane Butterfield was tried at Croydon, England, in August, 1775, for the murder of Mr. Scawen. It appears that she had resided with him for many years as his mistress.

Mr. Scawen had been salivated with a quack medicine from the beginning till the middle of April. After that it ceased, and his health was decidedly improved. But in the middle of June he was again attacked with severe salivation and its consequences; sloughs formed, and he died some weeks thereafter.

Against the prisoner, it was urged that the last sickness must have originated from the administration of corrosive sublimate in small doses, and that the previous medicine could not have induced these fatal consequences. Mr. Young and Dr. Sanders, witnesses for the prosecution, deposed that they had never known a salivation to recur after such an interval.

For the prisoner, on the other hand, Mr. Bromfield, Surgeon of St. George's Hospital, testified that he had repeatedly seen

* Christison, p. 389. In the case of Mr. Alfred S. Taylor, already referred to, no trace of the mercury could be detected in the contents of the stomach, nor in the coats of that organ. The blood, the spleen, the liquor pericardii, and the serous fluid of the peritoneum showed no trace of it. It is, however, not stated whether the kidneys or the urine in the bladder was examined. Mr. Taylor used the gold and zinc apparatus.

Professor Kramer, of Milan, asserts that he has detected the salts of mercury in the urine. (Medico-Chirurgical Review, vol. xlv. p. 465.) Dr. Glover, that he has found traces of mercury in the blood of a dog poisoned by corrosive sublimate. (Lancet, October, 12, 1844.) Audouard, in the urine and saliva. (Encyclographie des Sciences Médicales, March, 1843.)

cases in which the salivation had returned, after every effort had been made to evacuate the mercury from the system; that in one instance the interval had been three months; and that one of his patients was attacked periodically at intervals of six months or a month, for a whole year. Mr. Howard, another London hospital surgeon, confirmed Mr. Bromfield's evidence, by declaring that he had frequently experienced the same, and that mercury was of so subtle a nature that it was not possible for any man to say for what length of time it might lie dormant before it reappeared. He had known fifty instances of persons discharged from the Locke Hospital perfectly free of salivation, and upon some sudden change in the constitution, from cold or some other cause, they were as bad again as while they were under a course of mercury. The prisoner was acquitted.*

Dr. Gordon Smith, in commenting on this case, cites similar ones from Drs. Mead and Male, and adds the following on his own authority: "Dr. Hamilton, Professor of Midwifery in the University of Edinburgh, related a case in his Lectures, of a married lady, who had been under the necessity of going through a course of mercury, in consequence of her husband's imprudence, under the care of the late Mr. Bennet. This gentleman, from motives of delicacy, did not inquire very minutely into the particulars, but, according to the rule of the day, gave his patient a sore mouth. Four months afterwards she miscarried, and salivation again came on. It was removed for a week, at the end of which it returned, and harassed her for about a twelvemonth."†

These narratives are not, however, universally credited. "Granting the ptyalism to be in every instance really mercurial, it would require much better evidence than any practitioner could procure, to determine the fact that mercury had not been given again during the supposed interval." Doubt-

* Gordon Smith on Medical Evidence, p. 234; Dodley's Annual Register, 1775.

† Forensic Medicine, p. 114. See also his third edition, Appendix, p. 16. Dr. Graves, of Dublin, relates of a lady who had been subject for a length of time to occasional returns of salivation. (Lancet, N. S., vol. x. p. 176, from the Dublin Journal.)

less, also, in some cases, the salivation has been independent of mercury.*

Michael Whiting was tried and convicted at Ely, in England, in 1812, for administering poison to his two brothers-in-law, minors, in the event of whose death he expected some property. The corrosive sublimate was added to flour, from which it was intended to make dumplings; and it was in preparing these that the mutual action of the gluten and salt was witnessed, which I have already quoted. The boys found the food so disagreeable that they could not proceed in eating their dinner, and they were each taken ill. On analysis, corrosive sublimate was detected both in the boiled and unboiled dumplings, by chemists at Cambridge. The prisoner, before execution, confessed his guilt.†

Mr. Hodgson, a surgeon in Sunderland, was indicted in August, 1824, for administering poison to his wife, with an intent to murder her. Dr. Brown had been attending her for rheumatism, and had prescribed calomel and opium in repeated doses, with some relief to her complaints. On the 6th of June she was attacked, immediately after taking the same medicine, with violent burning in the throat, gullet, and stomach. She supposed some mistake had been made, but was urged to take the other dose; and after doing so, was still more violently affected. Severe vomiting, with cold skin and feeble pulse, ensued; the pain also was extreme down to the pit of the stomach. Dr. Brown, on being sent for, prescribed an anodyne draught; but was astonished, on tasting the medicine which had been prepared by the prisoner, to find it acrid, like corrosive sublimate. Becoming now suspicious, he prescribed whites of eggs, with immediate relief. The next day she had diarrhœa; and on the third, ptyalism; but she gradually recovered. The draught which Dr. Brown received from the prisoner was preserved and analyzed. Carbonate of potash produced in it a pale brick-red precipitate; ammonia, a brownish-white one;

* Christison, p. 372; *Medico-Chirurgical Review*, vol. v. p. 324. A number of cases of spontaneous salivation (apparently idiopathic) are referred to by Dr. Watson, in his *Lectures on the Practice of Physic*. (*London Med. Gazette*, vol. xxviii. p. 739.)

† *Edinburgh Medical and Surgical Journal*, vol. viii. p. 849.

lime-water, a yellowish-brown one; and when acted on by galvanism, it amalgamated gold. On the part of the prisoner, the principal plea was that he had made a mistake, in taking the wrong substance—having prepared a solution of corrosive sublimate for a patient. He was acquitted.*

It is of this trial that Dr. Christison remarks that a medical witness would be justified in giving an opinion, from the symptoms alone, that poison had been taken. "No natural disease could produce a sense of burning, from the throat to the epigastrium, *so very sudden and so very acute.*"

Antidotes. Alkaline salts and earths were formerly in high repute as antidotes to corrosive sublimate, and cases are to be found in medical journals where they would seem to have cured the sufferers.† They have also failed, and the same remark will apply to the sulphurets, the infusion of Peruvian bark, and sugar.

Our earliest aim must be the removal of as much as possible of the poison, by means of emetics. Subsequent to this, and indeed coincident with it, the use of albumen is highly important; we owe its introduction to Orfila. Whether the resulting compound be, as I have already intimated, only a partial conversion of the corrosive sublimate, still we have sufficient testimony in favor of its immediate exhibition. Our author proved its efficacy in several experiments on animals. "It has the advantage of being always at hand, and there is no danger of giving it to excess. The practical rule, therefore, is, that as soon as we are called to a person suspected of having taken corrosive sublimate, to make him swallow as much white of egg, well mixed with water, as the stomach can contain. This will immediately decompose the metallic salt remaining in the stomach; and if it excite fresh vomiting, so much the

* Edinburgh Medical and Surgical Journal, vol. xxii. p. 438. I have also the London Courier, of August 21, 1824, in which the report of the trial originally appeared.

† See a case in the Edinburgh Medical Essays, vol. vi. p. 432, from the *Commerce*. Norimb., 1735, where the *Oleum tartar per deliquium*, and mild drinks, appear to have been the principal agents in effecting a cure. The salt of tartar and salt of wormwood have each been recommended. (*Medical Commentaries*, vol. vi. pp. 324, 415.)

better. Along with this, blood-letting may be had recourse to, in order to overcome the inflammation already excited."* Mucilaginous drinks are very useful as accessory remedies.†

Several instances of recovery by this means are on record, and, in addition to those cited below, I will only mention that of Thenard, the chemist. While lecturing at the Polytechnic School, in February, 1825, he swallowed by mistake a glass of the concentrated solution of corrosive sublimate. In five minutes whites of eggs were obtained and taken. He vomited repeatedly, (more than twenty times,) but never had any pain or other ill consequence.‡

Dr. Taddei, of Italy, has lately recommended wheat flour, or gluten, as an antidote. He was led to this from ascertaining that it reduced corrosive sublimate to the state of calomel, and that considerable quantities of a mixture of flour or gluten with corrosive sublimate might be taken by animals without any injurious effects. In this way, fourteen grains of corrosive sublimate were given, in less than twelve hours, to rabbits and poultry, without injury; whereas a single grain would have been fatal if taken alone. Twenty-five grains of fresh, or thirteen of dry gluten, or from five to six hundred grains of wheaten flour are necessary to render a grain of corrosive sublimate innocent; and Dr. Taddei recommends that dried gluten be kept for the purpose in question in apothecaries' shops. When administered, it is only necessary to mix with a little water.§

Dr. Duncan objects to the preparation of gluten, as recommended by Dr. Taddei, as troublesome and tedious; and ob-

* Edinburgh Medical and Surgical Journal, vol. xi. p. 132. Dr. Peschier, of Geneva, has ascertained that it requires an ounce of whites of eggs to neutralize four grains of corrosive sublimate, taken as a poison. (London Med. Repository, vol. vi. p. 167.)

† A case in which the whites of eggs were given with perfect success is related by Dr. Lendrick, in the Transactions of the College of Physicians of Dublin. (London Medical Repository, vol. xv. p. 495.) See also other cases in *ibid.*, vol. xiii. p. 480; Dr. Johnson, in *New York Journal of Medicine and Surgery*, vol. ii. p. 210; Mr. Vautier, in *Edinburgh Medical and Surgical Journal*, vol. i. p. 205. It has, however, failed, in several instances, to save life.

‡ London Medical Repository, vol. xxiii. p. 435.

§ Taddei, *Recherches*; *Edinburgh Philosophical Journal*, vol. iii. p. 406.

serves that giving wheat flour, diffused through water, will prove equally efficacious.*

When neither albumen nor flour is at hand, milk is a convenient antidote of the same kind.

In experiments on animals, Milne Edwards and Dumas found that iron filings would decompose corrosive sublimate.† Meconic acid will also decompose it; but this is hardly to be recommended for the human subject.‡

Several other substances have been proposed as antidotes: but I doubt whether they have met with general acceptance.

Dr. Buckler, of Baltimore, has recommended the administration of gold dust, or leaf, and iron filings, in a very divided state, with a little gum, as a galvanic antidote. The result on some animals was favorable.§ Mialhe has proposed the hydrated protosulphuret of iron, and Orfila has certified to its chemical value; but the danger is in delay. Whites of eggs are always at hand.|| Lastly, Poumet proposes the protochloride of tin as an antidote, from its power to reduce a solution of corrosive sublimate in water, almost instantly, to a metallic state, while itself passes to a deutochloride. In several experiments on dogs, the result was successful.¶

The red precipitate and the red oxide of mercury. These substances, in considerable quantities, are violent poisons. Ploucquet mentions a case of an individual who, by accident, swallowed some red precipitate. He immediately experienced violent colics, copious vomitings, a trembling in all his limbs, and cold sweats.

* Duncan's Supplement, p. 140.

† Medico-Chirurgical Review, vol. ix. p. 612.

‡ Cannot physicians unite in abandoning the terms *protochloride* and *deutochloride* of mercury, *protomuriate* and *deutomuriate* of mercury, and return to the old-fashioned and distinctive ones of *corrosive sublimate* and *calomel*? How many lives have been lost by mistake in this way! Three children were thus poisoned at Paris in 1834. (Annales d'Hygiène, vol. xiii. p. 225)

§ American Journal of Pharmacy, vol. xi. p. 331. See, however, Lancet, N. S., vol. xxix. pp. 418, 644; and Pharmaceutical Journal, vol. i. p. 305.

|| Encyclographie des Sciences Médicales, July, 1843; Bulletin de l'Académie Royale de Médecine, October 15, 1842; see Bouchardat, in American Journal of Medical Sciences, N. S., vol. vi. p. 501.

¶ Comptes Rendus, vol. xx. p. 623.

There is a case recorded of poisoning by red precipitate. It occurred at Guy's Hospital, in 1833. The symptoms were cold surface, stupor, small and feeble pulse, eructation and frothy discharge from the mouth, with occasional vomiting of a red powder. There was no pain on pressure.

The stomach-pump was freely used, and afterwards flour and water and the whites of eggs were given. By these remedies the patient recovered; but salivation ensued, and there was some pain in urinating. The vomited matter was treated with dilute muriatic acid, and yielded metallic mercury.*

The red precipitate is readily ascertained by the application of heat to a little in a glass tube. Metallic globules are sublimed, and oxygen gas is disengaged.

Nitrate of mercury. There is one fatal case of poisoning by this, given by Dr. Bigsley: An escharotic liquid, used for the cure of "foot-halt" in sheep, is made by dissolving seven parts of mercury in eight of nitric acid. Of this, a lad aged sixteen, at Newark-upon-Trent, took a teaspoonful, for the purpose of committing suicide. Vomiting and great pain soon followed. The throat and mouth were very sore, and he retched violently, and the pulse laboring and indistinct. Diarrhoea succeeded.

The stomach-pump was used, and chalk given; but the pain continued from the mouth downward, and vomiting and purging recurred at intervals until his death, in three hours after taking the poison. His mind was unimpaired to the last.

On dissection, marks of inflammation were seen in the mouth, pharynx, and stomach. The mucous coat of each was of a deep rose red, with some eschars; but no perforation. The duodenum and colon were less strongly inflamed.†

* Mr. Brett, in *London Medical Gazette*, vol. xiii. p. 117. In another instance related by Mr. Alison, the female swallowed about thirty-five grains. An emetic of sulphate of zinc and ipecac. was immediately given, which caused instant vomiting. The stomach-pump was then employed. There remained for some time a burning pain, which was relieved by bleeding, and she gradually recovered. (*Lancet*, N. S., vol. xix. p. 401.

† *London Medical Gazette*, vol. viii. p. 329. In a case where a saturated solution of nitrate of mercury was by mistake rubbed into the hip and thigh, suppression of urine for five days followed. Profuse pytalism came on the third day, and the parts sloughed superficially. The patient, however, recovered. It is remarkable that no comatose symptoms ensued from the

Cinnabar or vermillion (sulphuret of mercury) would appear, from the experiments of Orfila on animals, to be innoxious, when well washed.*

According to the experiments of Barthez, the *deutobromide* of mercury is an active irritant poison. It produces high inflammation of the intestinal canal, and in some instances ulcers. When the experiment permitted, most of it was rejected by vomiting.†

Cyanuret of mercury. Kapeler mentions a case where twenty-three grains produced all the symptoms of poisoning with corrosive sublimate, and death ensued in nine days. Among the most striking effects were continued vomiting, salivation, with ulceration of the mouth, frequent diarrhœa, complete suppression of urine, semi-erection of the penis, and ecchymosis of it and the scrotum. Convulsive motions were present before the fatal termination. On dissection, the mucous membrane of the stomach and intestines was found highly inflamed, and the kidneys were swollen.

In the experiments made by Ollivier D'Angers with this substance, the symptoms and the appearances on dissection were similar to those described above. Violent vomitings occurred, accompanied with convulsions. It always acted more promptly when injected into the cellular tissue than when it was swallowed. Tiedemann and Gmelin detected its presence in the blood of the splenic and mesaraic veins of dogs and horses killed by it.

The nature of this poison may be ascertained, if in a solid state, by its quadrangular obliquely terminal crystals, its styp-tic taste, and its decomposition by heat, giving out cyanogen,

long-continued suppression. (Case by Professor Syme, Edinburgh Medical and Surgical Journal, vol. xliv. p. 26.)

The external application of acid nitrate, in several cases of itch, induced symptoms of poisoning, with salivation. (Ollivier D'Angers, in *Annales d'Hygiène*, vol. xxviii. p. 169.)

* "A patient in the surgical ward of the Louisville Hospital, laboring under a venereal ulcer of the palate, was directed to use mercurial fumigations, which he did in the manner and to the degree usually practised in the ward, but it proved fatal to him in less than half an hour." (*Western Journal of Medicine and Surgery*, No. 1, July, 1840, p. 84.)

† *North American Medical and Surgical Journal*, vol. vii. p. 219.

which may be burned at the end of a small tube. If it be fluid, add distilled water, and test with nitrate of silver, which will give a white precipitate (cyanuret of silver) insoluble in water and nitric acid, and soluble in ammonia, and with sulphuretted hydrogen gas, which will produce a black sulphuret of mercury.*

The *iodides of mercury* are considered poisonous, but we have no instances of their effects.

Turpeth Mineral, (subsulphate of the peroxide of mercury.) A boy, aged sixteen, swallowed a drachm of this, and it soon caused a burning sensation in the mouth and throat, vomiting, which was frequently repeated, a general sinking, cramps, and violent vomiting and purging. These were followed with great irritability of the stomach, salivation, ulceration of the gums, and extreme debility, and death ensued at the end of a week, without convulsions, nor had his brain ever been affected. The œsophagus was much inflamed, the stomach covered in various places with petechial spots, and the intestines were of a red color, contracted, and empty.†

It is not necessary to notice the other preparations of mercury in detail, since their effects in large quantities and their modes of detection, are similar to those already mentioned.‡

* Devergie, vol. ii. p. 707. There is another fatal case of poisoning by the cyanuret, given by Thibert, in his *Anatomie Pathologique*. The person took ten grains at once in the form of pills. The tongue and cheeks swelled to an enormous size; he could not speak or swallow, but there was no salivation; the urine was suppressed, and there was constant and not to be suppressed vomiting. He died in seven days.

† London Medical Gazette, vol. xxxix. p. 374.

‡ Only let it be remembered that all and each one of the preparations of mercury may prove poisonous. At a late coroner's inquest in London, an individual, aged forty years, was ascertained to have taken, on the 9th of August, six grains of blue pill and three of calomel, which produced a mercurial fever, under which he sank and died on the 26th of September.

That so small a dose should produce so violent an effect, though extraordinary, is not unparalleled. Christison says: "Fifteen grains of blue pill, taken in three doses, one every night, have excited fatal salivation. Nay, two grains of calomel have caused ptyalism, extensive ulceration, exfoliation of the lower jaw, and death." (London Medical Gazette, vol. xxxiii. p. 25.) I have no doubt that much of the calomel in common use contains a notable proportion of corrosive sublimate.

And I will only allude to the numerous cases which of late years have been described under the names of *hydragyria*, *mercurial erithrismus*, etc., as proving that the mildest preparations of mercury may, under certain circumstances, and in peculiar conditions of the system, prove dangerous, and even fatal.

Mercurial vapors, and mercury in a state of extreme division. Mercurial vapors are undoubtedly to be deemed poisonous. Many cases are on record which prove that workmen employed in mercurial mines, gilders, silverers of looking-glasses, etc., are subject to serious accidents from their callings. This, however, is a point which I shall notice at length in another place, when treating of the *diseases incident to particular trades and professions*.

The usual consequences of a long exposure to them are—"trembling and paralysis of the limbs, vertigo, loss of memory and of the other intellectual faculties; salivation and ulceration of the mouth; colic, asthma, hæmoptysis, atrophy, apoplexy, and death.

The following is a remarkable illustration of the effects of mercury, in a volatilized state, on the human system: A large quantity of quicksilver (about thirty tons) was saved from the wreck of a Spanish ship about Cadiz, by the Triumph man-of-war and the Phipps schooner, both English vessels. It was placed in their spirit-rooms. An alarming illness soon broke out among the crews, all of whom were more or less salivated. The surgeons, pursers, and three petty officers who were nearest the place where it was stowed, felt its effects the most, as their heads and tongues were swelled to a very alarming degree. Every rat, mouse, and cockroach on board the Phipps was destroyed. And it was noticed that those who slept close to where the quicksilver had flowed in consequence of escaping from the bags, suffered slightly in comparison to those who slept over the bags. Everything metallic was whitened.

The explanation of this distressing event is not difficult. The quicksilver had lain for some time in salt-water, and, when taken on board, the leather bags containing it rotted. Add to these the effects of gases generated on board ships, and we have sufficient agents at hand to cause the rise, suspension, and

oxidation of the metal. Dr. George Pearson suggested that sulphuretted hydrogen was probably the principal cause.*

When the effect of heat is added, the results are of the most marked kind. A conflagration broke out in the quicksilver mines of Idria in 1803, which resisted every effort for five weeks. As a last resource, the mine was laid under water. This succeeded, but it required two years to prepare an apparatus to pump out the water. "Even when the galleries had been cleared of the water it was impossible to work in them, partly from the heat they still retained, but still more from the fumes of sublimated mercury, which produced in the miners a violent salivation, accompanied with convulsions and trembling of the limbs. High wages were offered to such as would venture into places reckoned the most dangerous, to explore the consequences of the disaster, and collect the quicksilver which had been deposited in large quantities in the galleries. Many purchased this additional pittance with their lives; and the atmosphere continued for months so baneful that it was difficult to muster a sufficient number of healthy men for ordinary occupations."†

Whether metallic mercury should be deemed a poison, is a question concerning which there is much diversity of opinion. We know that it has often been exhibited in large doses with salutary effects, and indeed, in the days of Dr. Dover, two or three drachms of it were a common morning draught, as a preservative against gout and gravel. I apprehend that the proper distinction to be taken respecting it is, that when it can be so acted on as to be oxidated, even in the smallest degree, (as, for example, mixed with fat or oil, or even by friction

* Philosophical Transactions for 1823. Dr. Burnett, who gives this account, ascribes it to the mercurial vapors. (Edinburgh Medical and Surgical Journal, vol. vi. p. 513.) A correspondent of the Philadelphia National Gazette, (newspaper,) of March 25, 1824, says that he was a witness of this occurrence, and that the sailors, imagining it to be silver, concealed it in their pocket-handkerchiefs, and everywhere around their persons. The ship was so contaminated with it, that she was finally condemned as unfit for service.

† Edinburgh Journal of Science, vol. vi. p. 212, from Russel's Tour in Germany. Dr. Bright relates the fatal effects of extracting mercury by pressure out of the bags in which it is imported. (Medico-Chirurgical Review, vol. xx. p. 33.)

alone.) *it may* prove deleterious. Mr. Faraday has also contributed a valuable fact in illustration of this subject. He put some mercury in a clean, dry bottle of about six ounces, which formed a stratum at the bottom, not one-eighth of an inch in thickness. A small piece of leaf-gold was fastened on the under part of the stopper to the bottle, so that when the stopper was put into its place, the leaf-gold was inclosed in the bottle. It was then set aside in a safe place, and after some time the leaf-gold was found, on examination, whitened by the mercury. He repeated this experiment several times with similar results, and he deduces from it the conclusion *that, at common temperatures, mercury is surrounded by an atmosphere of the same substance.**

Detection of mercury in the body of a person dying of mercurial cachexy. The subject was a woman, who for twenty-

* Brande's Journal, vol. x. p. 354. This deduction will probably explain the following remarks of Dr. Falconer, of Bath: "Instances," he observes, "of all the ill effects even of the external application of mercury, are sometimes found in the use of what are called quicksilver girdles, which are often worn for the itch, especially by females of the lower rank, as being cleaner and more free from fœtor than a sulphurous application. Many of these cases have been admitted into the Bath Hospital. The symptoms were general weakness approaching to palsy, great pain and tremor in the limbs, and often violent headache." (Edinburgh Medical and Surgical Journal, vol. viii. p. 214, quoted from the Transactions of the Medical Society of London.)

Dr. John Davy has given the following parallel to the narrative of Faraday: In a press, from which light was excluded, and within which there was very little circulation of air, a pneumatic mercurial trough was kept, holding about thirty pounds of quicksilver, and also a bottle of iodine, closed, but not carefully, with a glass stopper. The trough stood on an under shelf, the bottle on an upper one, about two feet apart. After about two months that they had remained undisturbed, at a temperature ranging between 50° and 55°, having occasion to use the iodine, my attention was arrested by an efflorescence, as it were, of a brilliant-red color, consisting of minute crystals deposited on the upper rim of the neck of the bottle, not on its under, and on the stopper above, most abundant on the rim close to the stopper, gradually diminishing toward its top.

The red crystalline matter examined was found to be biniodide of mercury, and as such, it is, of course, a proof that the metal is capable of passing into a state of vapor at a comparatively low temperature. I did not attempt to determine the quantity of the iodide formed; from its appearance, it may be conjectured to have been at least one-tenth of a grain. (Edinburgh New Philosophical Journal, July, 1845.)

five years was laboriously engaged in silvering looking-glasses, but who, from the convulsive tremors induced, had been obliged to desist from her occupation for a year prior to her death. The chemical analysis by Fresenius and Babo discovered mercury in the liver, but not in the bile; the lungs and heart gave no trace of it. A doubtful precipitate was produced on the gold-plate by the brain, but none by the spinal column.*

ANTIMONY.

A great prejudice formerly existed against the use of metallic preparations, with the exception of iron, and this was carried to such a height, as to the compounds of antimony, that the faculty of Paris (among whom Guy Patin was the most conspicuous) obtained an edict of the parliament of Paris, prohibiting their use as a medicine. Nor was it until one of their sovereigns had been cured by the use of antimony that they (in 1666) demanded a sentence permitting its use.† It is to be feared, however, that the various preparations are often rashly and improperly employed at the present day.

TARTAR EMETIC. This substance, in large doses, must undoubtedly be deemed a poison. It is, however, far from being as certainly destructive as arsenic or corrosive sublimate.

The narrative of a few cases will properly precede the list of general symptoms:—

A Jew, by mistake, took about twenty grains of tartar emetic in the morning, fasting. In a few moments after swallowing it he experienced pain in the region of the stomach, which increased, and even brought on syncope. After this, excessive vomitings of bilious matter came on with alarming rapidity, with aqueous stools; the pulse small and concentrated; the face pale; great prostration of strength; the patient complaining of extremely painful cramps in the legs. By the use of proper remedies, the symptoms subsided after an illness

* Chem. Gaz., November 15, 1851.

† Philosophical Transactions, vol. ii. p. 710; see also Note to Abridgment, vol. i. p. 596.

of about six hours, and debility and painful digestion alone remained.*

A man, aged about fifty years, determined to poison himself, and for this purpose took about forty grains of tartar emetic on a Sunday morning. Vomiting, frequent stools, and convulsions soon succeeded. He was received into the Hôtel-Dieu on Sunday evening. On Monday morning he complained of violent pains in the epigastrium, which was distended. He could with difficulty move his tongue; he was, in fact, in such a state that he might be taken for a drunken man; he just spoke, and his pulse was imperceptible. During the day his abdomen became inflated, the epigastrium was considerably tumefied, and more painful; in the afternoon delirium came on. On Thursday all the symptoms increased; in the evening there was furious delirium; convulsions supervened, and he died at night.†

The following is a remarkable case: An individual had collected about twenty-five grains of tartar emetic for the purpose of poisoning himself. He went into a coffee-house and asked for a glass of sugared water, and having dissolved the mineral in this, he drank it down. Leaving the coffee-house instantly, he had scarcely proceeded twenty steps, before he felt a burning pain in the epigastric region, accompanied by convulsive movements and a loss of his senses. He was carried in this situation to the Hôtel-Dieu, ten minutes after the accident. On coming a little to himself, he confessed his crime; the decoction of bark was immediately administered in large quantities. The skin was cold and clammy; the breathing a little short; the pulse small and concentrated; the epigastric region a little tumefied and very painful; hiccough tolerably frequent but *no vomiting*. The symptoms gradually diminished in violence after taking the bark, and in two hours copious stools occurred, and continued for several hours. Next day he vomited several

* Case by Dr. Barbier, of Amiens, from Magendie. (Orfila's Toxicology, vol. i. p. 174.)

† Case by Dr. Recamier, from Magendie. (Orfila, Toxicology, vol. i. p. 177.)

times, and gastric symptoms were present for a week, but were removed by the usual remedies.*

From these and other instances, the following list of symptoms may be deduced; a rough, metallic taste, nausea, copious vomitings, frequent hiccough, cardialgia, burning heat in the epigastric region, pains of the stomach, abdominal colic, inflation, copious stools, syncope, small, concentrated, and accelerated pulse, cold skin, but sometimes intense heat, difficult breathing, vertigo, loss of sense, convulsive motions, very painful cramps in the legs, prostration, and death. Sometimes there is great difficulty of swallowing, and deglutition may be suspended for some time.† The vomitings and alvine excretions do not always take place, and the consequence of this is an increase in the violence of the other symptoms.‡

There can be no doubt, from the marked local effects of the tartar emetic ointment, that its external application in large quantities must produce injurious consequences.§

* Case by Dr. Serres, from Magendie. (Orfila's Toxicology, vol. i. p. 175.) Additional cases will be found in the Edinburgh Medical and Surgical Journal, vol. xix. p. 394; also in Guy's Hospital Reports for October, 1857.

By Dr. Duffin; his own case, from taking twenty grains by mistake.

Edinburgh Medical Essays, vol. iv. p. 35. By Mr. Stedman.

New York Medical and Physical Journal, vol. viii. p. 302. By Dr. Charles Lee. A child, a few weeks old, swallowed fifteen grains in solution; vomiting and purging ensued, followed by convulsions and death.

Boston Medical and Surgical Journal, vol. iii. p. 592. By Dr. Usher Parsons. Three of the ward-room servants on board the U. S. squadron on Lake Erie, in 1813, in meddling with the medicine-chest, took, by mistake for cremor tartar, upwards of forty grains of tartar emetic in solution. They were seized with vomiting and purging, weak, contracted pulse, and cold, clammy sweats. All, however, recovered after a few days, by the use of proper remedies.

† Foderé quotes a case by Dr. Carron, where there was a suspension of deglutition for two days. (Vol. iv. p. 156.)

‡ Orfila's Toxicology, vol. i. p. 178. Male mentions the case of a child who had taken a large dose, and in whom no vomiting occurred. He lay in a state of insensibility; the extremities cold; the pulse languid and almost imperceptible; but by taking some strong brandy and water these effects were removed, violent vomitings succeeded, and the patient recovered. (Page 166; see also Journal of Foreign Medical Science, vol. i. p. 640.)

§ The immunity experienced from large doses of tartar emetic, when given for inflammation of the lungs, a practice which had its origin in Italy, is now explained on the idea of a peculiar condition of the system that accompanies

Appearances on dissection. The mucous membrane of the stomach is usually red, inflamed, and covered with mucus. The duodenum is in a similar state, and occasionally the other small intestines. The lungs are often found more or less inflamed, and in some instances the brain is so also, and contains serous fluid. In a general way, we may state that the mucous membrane of the digestive canal and the lungs are the organs principally affected by this poison.*

In Dr. Lee's case, the mucous coat of the stomach was red and softened, and the duodenum of a deep-red color. The brain and the right side of the heart were distended with blood.

Effect on animals. Magendie and Brodie have each investigated the effects of this salt on animals.

The former ascertained that whenever the œsophagus was tied up in dogs, so as to prevent vomiting, four, six, or eight grains produced death at the end of two or three hours; while those who were able to get rid of it by vomiting, often took a drachm, without experiencing any material bad effect. Large doses, (as half an ounce,) however, generally caused death in a few hours, or a few days, although instances did happen where no accident followed from their exhibition.

When a solution of tartar emetic, or six or eight grains to three ounces of water, was injected into the veins of a full-grown dog, vomiting and purging ensued, the breathing became difficult, the pulse frequent and intermitting, and great disquietude and trembling of the limbs preceded death. On dis-

the disease. Twenty grains have thus been given every four or five hours, to the amount of five scruples, without causing either vomiting or diarrhoea. With the return of health, however, the exemption from the ordinary effects ceases.

In the autumnal fevers of our own country, and particularly those of the Western States, I have no doubt that a large majority of fatal cases have been owing to the too free use of tartar emetic. Such is the testimony of Dr. Drake and other physicians in that section of the Union. Cramp in the stomach is almost the earliest result, and if this be recovered from, inflammation (actual gastritis) often supervenes. Certainly the use of ipecacuanha is far preferable in these cases. (Western Medical and Physical Journal vol. i. p. 297.)

* Orfila's Toxicology, vol. i. p. 177.

section, the lungs were observed of an orange or violet color, and distended with blood, while the mucous membrane of the intestinal canal, from the cardia to the rectum, was red and inflamed. A large quantity, injected in a similar manner, produced an earlier death, and the inflammation was confined to the lungs; but a weaker solution took a longer period to develop itself, and the lungs and intestines were equally affected.*

It thus appears that, as a general rule, its first effect is almost always vomiting, in those animals who are capable of this function, and the poison is thus thrown off in many cases before it has had time to produce fatal consequences.

The results obtained by Mr. Brodie were similar in many respects. When applied to a wound in animals capable of vomiting, it usually, but not constantly, operated as an emetic. Paralysis, drowsiness, and at last complete insensibility, were among the symptoms that preceded death. The stomach sometimes bore the marks of inflammation, but he never saw any appearance of it in the intestines. These experiments were performed on rabbits, and the same symptoms were present, whether the tartar emetic was injected into the stomach or applied to a wound. The deduction drawn by Mr. Brodie from these results is, that this mineral does not produce its deleterious effects until it has passed into the circulation.†

Tests. For these I shall follow Professor Turner, who has very carefully and ably examined them.‡ I will, however, premise that there is considerable discrepancy among chemists as to the solubility of tartar emetic. Dr. Duncan, Jr., is said to have selected very pure specimens for this examination, and he states that one part is soluble in three times its weight of water at 212°, and in fifteen at 60°. Probably it may be proper, in ordinary cases, to add rather more than these proportions, and particularly as much of the salt in use is far from being pure.

* Magendie, pp. 24, 36, 37.

† London Medical and Physical Journal, vol. xxviii. p. 126.

‡ On the Detection of Antimony in Mixed Fluids. (Edinburgh Medical and Surgical Journal, vol. xxviii. p. 71.)

(a.) Caustic potash precipitates it white, if the solution be strong. The first portions of the test have no effect, as the tartrate contains an excess of acid, which must be neutralized. The precipitate thrown down, which is the oxide of antimony, is redissolved by an excess of potash.

(b.) Lime-water gives a white precipitate, but not if the solution contains only half a grain to an ounce.

(c.) Subcarbonate of potash is more delicate, and also gives a white precipitate.

(d.) Muriatic and sulphuric acids throw down a white precipitate, and take it up when added in excess.

(e.) Infusion of gall-nuts gives a dirty yellowish-white precipitate, but is not a minute test.

(f.) The most minute test is sulphuretted hydrogen. In a solution containing only an eighth of a grain per ounce, it strikes an orange-red color, which, when the excess of gas is expelled by heat, becomes an orange-red precipitate; and if the proportion of salt is greater, the precipitate is thrown down at once.

(g.) Hydrosulphuret of ammonia, applied to the solution, causes a similar precipitate.

The following table, showing the power of tests in detecting this metal, is given by Devergie:—

	Times its weight.
Hydrochloric acid, (no precipitate).....	2,500
Sulphuric acid, "	1,000
Tincture of nut-galls, "	1,000
Lime-water.....	1,200
Potash and soda, each.....	2,000
Hydrosulphuret of ammonia.....	100,000
Sulphuretted hydrogen.....	100,000*

Reinsch's and Marsh's tests, as used for the detection of arsenic, are also applicable to the antimonial compounds. (See pages 572 and 573 of this volume.) Antimonial preparations are sometimes contained in the arsenic.

The juices of plants, the extractive decoctions of roots and barks, precipitate the solution of tartar emetic, and produce a reddish-yellow deposit, consisting of oxide of antimony and a

* Devergie, vol. ii. p. 770.

portion of vegetable matter. According to Dr. Paris, one ounce of the decoction of yellow bark is capable of decomposing one scruple of this salt, and rendering it completely inert.

Tartar emetic poured on milk produces no coagulation, and the mixture gives a clear-red precipitate, with the hydrosulphuret of ammonia. Broth and bile, diluted with water, do not alter the action of agents on the tartar emetic.*

In all cases of mixed fluids, Dr. Turner advises that the suspected fluid be acidulated with a little muriatic and tartaric acids. The former will coagulate various animal principles which may be present; and the latter possesses the property of readily dissolving all precipitates whatever, formed by reagents with tartar emetic, except that caused by sulphuretted hydrogen. The fluid so prepared is to be filtered, and a sulphuret formed and collected in the usual way. This may be placed in a horizontal tube, and a continued stream of hydrogen gas passed through it.†

When all the oxygen of the atmosphere is expelled from the apparatus, heat may be applied with a spirit-lamp to the sulphuret. The result is, that sulphuretted hydrogen is evolved and metallic antimony is left, if the current of hydrogen is gentle, or it is sublimed if the current is rapid. This mode of proceeding was sufficient to detect the metal from only a tenth part of a grain of the sulphuret. If any doubt remain, dissolve the contents of the tube, in nitric acid, and throw down again the orange sulphuret with sulphuretted hydrogen.‡

Antidotes. Vomiting, if not already present, should be excited by tickling the throat, and the administration of warm water in large quantities, and even if it has taken place, warm

* Orfila's Toxicology, vol. i. p. 166.

† This process was adopted from the known fact that hydrogen will separate sulphur from antimony at an elevated temperature. In performing the experiment, one end of the tube should be connected by means of a cork with a vessel from which the hydrogen is evolved, and to its other end a bent tube must be adjusted to open under water, so as to carry away the hydrogen and at the same time exclude atmospheric air.

‡ The tests of Vogel and others, of *antimoniretted hydrogen*, may also be applied, particularly when the antimony is in very small quantity.

water is advisable to relieve the symptoms. If, notwithstanding the employment of these means, vomiting cannot be induced, we should exhibit the decoction or tincture of bark. This was proposed by Berthollet, and its value is great, from the fact of its decomposing the salt. Strong tea, the decoction of nut-galls, or of astringent roots and barks generally, will answer as substitutes, when the bark cannot be obtained.

Opium may be employed in excessive vomitings, and the antiphlogistic treatment is generally necessary to remove the secondary symptoms.

THE OXIDE AND GLASS OF ANTIMONY. These substances are poisonous, even in small doses. Hoffman mentions fatal cases, produced by the latter, where the symptoms were similar to those caused by tartar emetic; and Morgagni quotes instances where men and animals died from its exhibition. Inflammation of the stomach was observed on dissection.*

Both the oxide and the glass, being mixed with charcoal, and heated in an earthen crucible, furnish metallic antimony.

THE MURIATE (*butter of antimony*) AND SUBMURIATE OF ANTIMONY. These, also, are deleterious substances. Orfila quotes a case from Borrichius, where a few strong doses of the submuriate caused violent purging and vomiting, a copious salivation, and extreme debility. For some time previous to death the patient was cold as ice, his pulse was scarcely perceptible, and he breathed with difficulty. He nevertheless enjoyed all his intellectual faculties.†

ANTIMONIAL WINE. The composition and strength of this preparation vary according to the purity of the solvent, and as this is liable to alteration, a degree of insecurity attaches to its exhibition. And I have no doubt that children have often been injured by its administration without proper advice. I will only advert to the cases quoted by Orfila from Mangetus and Fabricius Hildanus, as proofs of the dangerous and even

* Morgagni, vol. iii. p. 370.

† Orfila's Toxicology, vol. i. p. 190. Several other cases are mentioned by Mr. Taylor, one of which communicated by Mr. Mann, proved fatal in ten and a half hours. (On Poisons, p. 494.) See also a case by Mr. Houghton. (Lancet, December 4, 1841.)

fatal effects of this substance. Certainly the solution of tartar emetic in water is a far preferable prescription.

For each of the above compounds of antimony, the tests already advised may be used.

ANTIMONIAL VAPORS. Fourcroy (says Orfila) relates that he has seen fifty persons who were seized with a great difficulty of breathing, tightness of the chest, and a dry cough, gripings, and purging, ten or twelve hours after having respired the vapors of sulphuret of antimony, which had been detonated with nitre. The prolonged action of these might undoubtedly lead to serious evils.

The injurious effects of the vapors of antimony to workmen engaged in the manufacture of its various salts, are detailed by Dr. Lohmeier.*

KERMES MINERAL and the other sulphurets are doubtless also poisonous. M. Bonjean has, however, shown by analysis, in the case of an animal destroyed by it, that it was not absorbed, nor could it be detected in any of the viscera. The contents of the stomach and intestines were, however, found to indicate its presence. He supposes that all the *insoluble* compounds of antimony will act in a similar manner.†

COPPER.

The preparations of this metal are seldom used as the instruments of crime, but they are frequently poisonous through accident; and this is owing to the circumstance of copper being extensively employed for domestic utensils.

I shall notice first the nature of metallic copper, and then the action of its various compounds.

METALLIC COPPER. The weight of testimony is decidedly in favor of this not being poisonous, when perfectly pure. Orfila cites several cases from authors, where masses were swallowed, and after some time voided by the natural passages, without producing any injury. Dr. Paris mentions an

* Edinburgh Med. and Surg. Journal, vol. lv. p. 265. The reader will find some curious results noticed as to their effects on the sexual organs.

† Encyclographie des Sciences Médicales, February, 1844.

instance where six copper penny-pieces were taken with a view of self-destruction, and no inconvenience was experienced, except the effects of mechanical obstruction. They were voided after a lapse of five years.*

It is not so certain that this substance in a state of minute division, as filings for example, is equally innocuous. Portal relates a case where they were given to an individual laboring under ascites, and while the disease seemed to yield, colic, tenesmus, and vomitings suddenly intervened.† Experiments on animals, however, with large doses of copper filings, mixed with grease or oil, have produced no injury, and on dissection, their metallic brilliancy was found untarnished.

But we have always reason to dread the effects of this metal on the human system, from the facility with which it oxidates. Copper exposed to a moist atmosphere becomes tarnished, and passes into a state of oxide, which soon after unites with the carbonic acid of the atmosphere and forms a greenish carbon-

* Paris' Pharmacologia, p. 250. Dr. A. T. Thomson mentions two instances in which half-pence were swallowed, and remained, the one six months and the other two months, before they were evacuated. In neither case was the health injured. (London Dispensatory, p. 273.) Dr. Corbett gives another, where a half-penny was retained three months. (Lancet, N. S., vol. ix. p. 294.)

On the other hand, the following seem to contradict the usual results; but it is probable that these peculiarities were owing to some previous oxidation of the metal: "A child, aged three years, swallowed two copper farthings by accident, at an interval of half a year after each other. After swallowing the first he ate nothing for ten days, complained of great pain at his stomach, and drove as if he had been salivated. After the second, he began by degrees to lose his flesh, and had the appearance of consumption. He was, however, perfectly cured by the Bath waters." (Communication by Dr. Edward Baynard, Philosophical Transactions, vol. xx. p. 124.)

A case is also mentioned by Dr. Jackson, of Boston, where the swallowing of a half-cent produced nausea and vomiting, with several other symptoms characteristic of the poison. (New England Journal, vol. viii. p. 156.)

In a boy who swallowed a cent, severe vomiting followed, and in two days profuse salivation, which continued for some time. He discharged it at the end of five weeks, perfectly bright, but the soreness of the mouth remained until that time. (Case by Dr. Budd, Coxe's Medical Museum, vol. ii. p. 178.)

Dr. Gloninger relates a similar case, also accompanied with salivation. (American Medical Recorder, vol. vi. p. 583; and also Dr. Percival, in his Essays, vol. ii. p. 221.)

† Orfila's Toxicology, vol. i. p. 201.

ate.* It dissolves in the principal mineral acids, with the aid of heat. Milk, however, although boiled for two hours in a clean kettle, did not contain any trace of copper, and the same result was obtained with tea, coffee, beer, and rain water. But if the water contained muriate of soda, it dissolved a notable portion of copper. These results were obtained by Mr. Eller, a chemist at Berlin, and he noticed as a remarkable circumstance that if, instead of a simple solution of muriate of soda, (common salt,) it was previously mixed with beef, bacon, or fish, the fluid resulting did not contain a trace of copper.† Fat bodies assisted by the oxidizing principle of the atmosphere, also act with celerity on copper.

We must remark, however, that vegetable acids generally dissolve the metal with difficulty, even although assisted by heat. And hence, the boiling of sugar or syrups in vessels of this metal does not itself produce any noxious compound, unless it be left to cool in them. In the latter case, the boiled substance acquires a bad taste and a green color, and the copper forms an oxide on its surface.

These facts are sufficient to prove the necessity, in all cases, of tinning vessels intended for the preparation of articles of food. Numberless causes, says Proust, unite to accelerate the dissolution of the copper, since the juices of all viands are fat, acid, and naturally saline. It is, therefore, evident that tinning is indispensable for kitchen utensils.‡ And this author

* Some years since, it was asserted that the water supplied to the India ships, touching at St. Helena, contracted poisonous qualities by being kept for a long time in tanks of copper. Although no trace of the metal could be found on analyses, still it is quite possible that the water may become noxious. The joint influence of air and moisture, we are sure, will corrode the metal. By agitation, this crust will be detached, and may be diffused through the water; and successive corrosions may increase the quantity, particularly on board of ships.

† Orfila's Toxicology, vol. i. p. 202. Sir Humphrey Davy, in his investigations on the preservation of the copper sheathing of ships, makes the following remark: "Weak solutions of salt act strongly on copper; strong ones, as brine, do not affect it; and the reason seems to be, that they contain little or no atmospheric air, the oxygen which seems necessary to give the electro-positive power to menstrua of that class." (*Annals of Philosophy*, N. S., vol. ix. p. 299.)

‡ Cleanliness may, however, ward off any formidable injury. "In the

has also shown another advantage arising from this precaution. The usual alloy applied in tinning vessels consists of equal parts of tin and lead, and the tin, being more oxidizable than the lead, is exclusively dissolved by any vegetable acid that may be contained in the viands, and thus prevents the latter from being attacked. These compounds of tin are known to be harmless.*

Copper and bell-metal mortars are evidently hazardous, for similar reasons, in the office of the apothecary. Not only will moisture affect them, but also many articles of the *materia medica*, and thus dangerous compounds may result.†

OXIDE AND CARBONATE OF COPPER. The carbonate (natural verdigris) forms spontaneously on the surface of copper or brass vessels, pieces of coin, etc., when treated with ammonia or water, and is of a green color. The oxide is of a blackish-brown color. Both of them are highly poisonous, and colic and vomiting are their usual symptoms.

From the remarks made in the previous section, it will be readily understood why copper utensils, when not properly cleaned, contaminate acid substances boiled in them. Vinegar dissolves the oxide with ease, as does also ammonia. Eller has proved that wine dissolves copper, doubtless in consequence of the acetic acid contained in it, and the oxidation of the metal by the air;‡ and we can explain in the same way

Orphan House at Halle, from 600 to 900 persons daily eat food dressed in large copper kettles; and yet I never heard there of any bad effects from them. Here, however, I must observe, that the cleanliness was quite exemplary; that in the afternoon we observed, with pleasure and admiration, the kitchen perfectly clean, and the copper vessels bright." (Michaelis' Commentaries, vol. iii. p. 338.)

* Mr. Proust's papers on *Tinning*, which appeared originally in the *Annales de Chimie* and *Journal de Physique*, I have consulted in the *Repertory of Arts*, second series, vols. vi. and ix.

† There is a useful paper on this subject in the *Medical Commentaries*, vol. vii. p. 311. The author first shows that bell-metal mortars are liable to abrasion; that thus the particles may be united with medicines; and next, that some substances will act chemically on them.

‡ Moseley relates that, in 1592, at a meeting of the great senate of Berne, the wine was put into copper vessels, and suspended in a well, in order to cool it. In a few days, the legates and others who had drunk, were seized with violent pain in the abdomen, fever, and dysentery, and many died. (Moseley on Tropical Diseases, p. 331.)

the production of the acetate in the cocks of the vessels from which wine, beer, or cider is drawn. "Drouard was affected for three days with colic and diarrhœa, in consequence of eating a ragout which had been seasoned with wine drawn out of a cask the cock of which contained acetate of copper, which this liquor had in part dissolved." Fat bodies, such as fixed and essential oils, etc., dissolve the oxide and carbonate of copper with readiness; and hence Proust very justly condemns the use of copper measures for oil.*

The tests of these compounds are similar to those of verdigris, which we shall now notice.

VERDIGRIS. The compound substance known under this name is the preparation of copper which most frequently produces deleterious effects. Orfila has collected numerous cases illustrating its action, and I conceive it will be useful to state the mode in which the respective individuals were poisoned. In one instance, a family consisting of nine persons were affected; the first of these by a cake made with melted butter, and skimmed with an instrument of copper, upon which the fat body had been allowed to cool; five from some broth and meat coming out of a saucepan, skimmed by the same skimmer; and the remainder, by a fricassee of pigeons, prepared in the same pan. The Jacobin friars in Paris, to the number of twenty-one, were poisoned in 1781, by eating some ray which had been cooked in a copper vessel. The cook, after taking out a part of the water, had poured vinegar on the fish to render them more firm, and in this state they had stood for some time away from the fire. Some veal placed in an earthen pot, to which there was a copper lid, and which laid directly on the meat, affected two individuals. So also eggs prepared with sorrel and butter in a copper vessel, which was covered with verdigris. Dupuytren mentions a case where a whole

* Orfila's Toxicology, vol. i. pp. 203 to 206. In several cities in Europe, distillers, apothecaries, and others are forbidden to use copper vessels unless they are tinned. (Ehrmann, in Schlegel, vol. iii. p. 230.) Of late, copper vessels have been plated by the electrotype process. Mr. Warrington asserts that vessels of this kind are acted upon by weak acids, as lemon-juice or vinegar, if allowed to remain in them for but a short time. (Medico-Chirurgical Review, vol. xliii. p. 553.)

family was poisoned from eating lobsters which had been cooked and afterwards placed in a copper kettle with vinegar poured over them. Even peas which remained for a day in a copper vessel have produced all the characteristic effects of poisoning from copper.*

Verdigris itself is also sometimes used as the instrument of suicide. A lace-worker at Paris put eight sous-pieces in a

* *Medico-Chirurgical Review*, vol. i. p. 158, quoted from a French medical journal. For similar cases, see *Medical Observations and Inquiries*, vol. ii. p. 146. Case by Mr. Ramsey, of a number of men on board the *Vestal* frigate in 1757, taken suddenly ill, with convulsions and delirium, pain and suffused eyes. Also a boy, violently attacked from eating peas that had remained a day in a copper vessel.

Annales d'Hygiène, vol. viii. p. 483. An enumeration of various cases of food thus becoming poisonous.

Percival's *Essays*, vol. ii. p. 221. A female ate three or four ounces of pickled samphire. A rash appeared in the evening, which disappeared on the next day. To this succeeded pain, thirst, costiveness, vomiting, hic-cough. The discharges were extremely offensive, and the abdomen tender to the touch; the hiccough became almost incessant. Various remedies were given without benefit, and she died on the tenth day. Dr. Percival states that he has seen similar severe sufferings, but which did not prove fatal, in a young man, a brass-founder, who drank water out of an old tea-kettle, the inside of which was covered with verdigris.

Annals of Medicine, vol. vii. p. 401. Case by Dr. Yeats, of poisoning from eating pickled salmon seasoned with vinegar. The eyes were much affected in these individuals, and dimness of sight was followed by dilated pupils.

London Medical Quarterly Review, vol. ii. p. 93. Case quoted from Mr. Swan, of illness from eating hashed hare that had stood in a brass pan.

Boston Medical and Surgical Journal, vol. ii. p. 305. Case by Dr. Higginson: A large family poisoned with milk. In two hours after taking it they were all seized with nausea and vomiting; proper remedies, however, soon relieved them. Dr. Charles T. Jackson analyzed the milk, and found sub-acetate of copper in it.

Medical Facts and Observations, vol. i. p. 61. Case by Mr. Davidson, of a mother and four children suffering under an extensive cutaneous eruption, probably from dining on pea soup, which was distributed with a ladle that had been long out of use, and was quite green.

Annales d'Hygiène, vol. x. p. 84.

Journal de Pharmacie, vol. xxiv. p. 420. The sorrel plant, cooled in copper vessels, has proved injurious. It would seem, however, from some observations of Planche, (*ibid.*, p. 418,) that this substance, although containing so much acid, sometimes dissolves but an extremely small portion of copper, certainly not sufficient to prove poisonous. He therefore advises that, in criminal cases, the quantity of copper, as well as its actual presence, be determined.

glass of strong vinegar, and left them there for seven days. At 2 P. M., having made a good dinner, he drank first one-half, and in fifteen minutes after, the remainder of the potion. Not content with this, he washed the coins in more vinegar, brandy, and anise-seed water, all of which he swallowed. Three hours afterwards, he was found insensible. The muscles were violently convulsed; the teeth set; the breathing interrupted; the pulse small, hard, and very slow; the pit of the stomach tender on pressure. He recovered his senses in half an hour, and then told what he had swallowed. Whites of eggs were immediately given in large quantities. The convulsions soon ceased, but the hiccough continued for many hours. Next day the abdomen was very painful; pulse full, slow, and intermitting; the convulsions partial and transient. Leeches were used, and the whites of eggs continued. In the evening he had colic, hiccough, and a contracted pulse; but gradually recovered from this and went on improving until the fourteenth day, when he was dismissed cured.*

It is not necessary further to copy the detail of any particular case, since the leading symptoms in all are generally very similar. They are thus stated by Orfila: "An acrid, styptic, coppery taste in the mouth; parched and dry tongue; a sense of strangulation in the throat; coppery eructations; continual spitting, nausea, copious vomitings, or vain efforts to vomit; shooting pains in the stomach, which are often very severe; horrible gripes; very frequent alvine evacuations, sometimes bloody and blackish, with tenesmus and debility; the abdomen inflated and painful; the pulse small, irregular, tight, and frequent; syncope, heat of skin, ardent thirst, difficulty of breathing, anxiety about the præcordia, cold sweats, scanty urine, violent headache, vertigo, faintness, weakness in the limbs, cramps of the legs, and convulsions." All these, however, do

* Edinburgh Medical and Surgical Journal, vol. xxxiii. p. 220, from *Revue Médicale*. Another case is quoted by Metzger from Pyl, p. 396. The verdigris was found in the pylorus, and it had tinged the fæcal matter. Serious cases, accompanied with the usual symptoms, are mentioned by Mr. Armstrong, arising from eating ornamental sugar, such as is placed on table at the dessert, and which, on analysis, was found to contain a considerable quantity of acetate of copper. (*Medical Times*, vol. x. p. 495.)

not generally occur in the same individual, but vomiting and colic are very constant.

"Another symptom," says Christison, "which occasionally occurs in this kind of poisoning, and never, as far as I know, in poisoning with arsenic or corrosive sublimate, is jaundice." Dr. Thomson corroborates this remark, and adds as a further diagnostic symptom, a singular tinge of blue around the eyes.*

Gangrene sometimes takes place in the intestines, and this disease is then accompanied with its usual premonitory appearances.

Sulphate of copper, (blue vitriol.) "The most dreadful case of convulsions I ever saw," says Dr. Percival, "was produced by blue vitriol, on a young woman who had swallowed about two drachms of it in a fit of desperation. By evacuants, demulcents, and such absorbents as have the power of decomposing the metallic salts, she happily recovered. In the interval of her fits, she was perfectly rational."†

Fatal cases are also recorded. An individual, aged forty, took voluntarily an ounce of the sulphate in the morning. He was soon seized with violent colic and frequent vomiting of a bluish matter. But little assistance could be afforded to him, as he refused to mention the nature of the poison, and he died in the evening. The œsophagus was found of a livid-red color, the stomach of a bluish hue, which could be washed off; and under this, the mucous membrane was of a deep red. The intestinal tube, throughout the whole extent, was highly inflamed.‡

Appearances on Dissection. If death takes place very rapidly, it is probable that few, if any, diseased appearances will be observed. Such at least was the case with animals.

* Christison, 3d ed., p. 435; Lancet, N. S., vol. xx. p. 567. The skin was yellow in several cases related by Pyl and Wildberg.

† Percival's Essays, vol. ii. p. 221. The sulphuret of copper would seem, according to the experiments of Orfila, to be innocuous.

‡ British Annals of Medicine, vol. ii. p. 311. Some of the salt was, through ignorance, given to a child, sixteen months old. It died in four hours, having vomited a bluish-green liquid, and becoming insensible for some time before death. It was not, however, convulsed. (London Med. Gazette, vol. xviii. p. 742.)

In protracted cases the alimentary canal is the organ principally diseased. The mucous lining of the stomach and intestines is found to be inflamed and gangrenous, and this extends even to the rectum. In one instance, that intestine was found pierced at two points. Sometimes the inflammation extends to all the coats, and sloughs are formed, which leave openings through which their contents pass into the cavity of the abdomen.* Metzger remarks that the green color of the salt tinges all the fluids contained in the primæ viæ.† Inflammation of the brain has occasionally been noticed.‡

Effects on animals. The experiments of Drouard on dogs led him to the conclusion that verdigris acts immediately on the alimentary canal, in which it excites inflammation, without being taken up into the circulation by the lymphatic vessels. To a young dog twelve grains were given, which produced death in twenty-two hours. The stomach was found inflamed, and exhibited a black spot which might have been taken for an erosion. The small intestines showed no marks of inflammation, but the rectum contained small ecchymoses similar to those in the stomach. In another instance, the stomach and duodenum were inflamed and the rectum natural.

When a small quantity in solution was injected into the jugular vein, death ensued in half an hour. The trachea and bronchiæ were filled with frothy mucosities, and the great vessels were distended with black and fluid blood. But in a dog who survived to the fourth day after this operation, nothing peculiar was observed either in the digestive organs or the vessels. Large doses, indeed, seem to produce sudden death, preceded by vomiting, convulsive motions, great insensibility, and paralysis, and present at the same time but slight alterations on dissection. Orfila considers these facts as invalidating the doctrine of Drouard, and conclusive in favor of the absorption of the poison, and its action on the nervous system.

* Orfila's Toxicology, vol. i. p. 224; Christison, p. 224.

† Metzger, p. 131.

‡ Male, p. 147. Mitscherlich found in rabbits, poisoned by sulphate of copper, the blood coagulated in the heart and its large vessels.

Tests. The tests of copper in solution, are—

(a.) Ammonia gives a blue precipitate, but if added in excess, the precipitate redissolves, and the liquor is of a beautiful blue color.

(b.) Sulphuretted hydrogen gas causes a brownish-black precipitate, the sulphuret of copper.

(c.) Ferrocyanite of potash gives a fine, hair-brown precipitate, the ferrocyanite of copper.*

(d.) A clean plate of iron held in a solution of sulphate of copper becomes covered in a few hours with a red, powdery crust, which is the copper in a metallic state. The blue color of the solution grows first green and then red. A sulphate of iron has been formed in it.

(e.) Caustic potash precipitates it of a sky-blue color, the hydrated peroxide of copper.

(f.) Oxide of arsenic, with the previous addition of a few drops of ammonia, gives a fine apple-green precipitate, the arsenite of copper, or Scheele's green.†

[*The galvanic test.* If a few drops of a copper solution be placed on platina-foil, slightly acidulated, and touched through

* Bontigny states that the ferrocyanate will not produce its effect when iron is in solution with the copper, in the proportion of one, or more, to two. In such a case, he advises, after solution in nitric acid, to add ammonia in excess, which precipitates the iron and the earthy salts. Muriatic acid is then used, sufficient to render the solution slightly acid, when the ferrocyanate of potash will produce its characteristic appearance. (*Annales d'Hygiène*, vol. xx. p. 461.)

Levol (*Journal de Pharmacie*, March, 1843.) makes a somewhat similar objection to ferrocyanate as a test, viz., that when added to liquids with an acid reaction, it decomposes rapidly, and forms a precipitate of Prussian blue, and this it does even when not a trace of iron is present. To obviate this difficulty, he proposes to add one volume of ordinary caustic ammonia to three volumes of an aqueous solution of ferrocyanuret of potassium, half saturated, without heat, (11 parts of ammonia to 100 of the salt.) He found it an extremely minute test, and the precipitate was readily cognizable of a crimson-brown color. (*Chemist*, vol. iv. p. 259; *Encyclographie des Sciences Médicales*, July, 1843. p. 10.)

† Orfila's *Toxicology*, vol. i. p. 206; Christison, p. 402. A writer in the *Philadelphia Journal of Pharmacy*, vol. vi. p. 184, says that ferrocyanate of potash strikes a red color with copper. Turner says it is a reddish brown. (This discrepancy is thus reconciled by Orfila: It strikes, he says, a red color which in a short time settles into a reddish-brown precipitate.)

the solution with a slip of zinc, metallic copper will be deposited on the platina.]

According to Devergie, the minuteness of the test takes the following order:—

A plate of iron (aided by acetic acid) will detect one part, dissolved in.....	Parts of water.
Arsenite of potash.....	5,000
Carbonate of ammonia.....	10,000
Potash.....	14,000
Potash.....	14,500
Hydrosulphuret of ammonia.....	60,000
Sulphuretted hydrogen.....	60,000
Ferrocyanate of potash.....	80,000*

According to Harting:—

	Parts of water.
Prussiate of potash.....	78,000
Ammonia	9,400
Polished iron (if the solution be acidulated with a drop of nitric acid).....	125,000†

The following are mentioned by Orfila as the effect of animal and vegetable substances on it. The infusion of tea decomposes the solution of the acetate of copper, and a flaky precipitate of a reddish-yellow color is produced. If one part of a concentrated solution of verdigris be added to ten parts of red wine, the liquor preserves its transparency, and the hydrosulphurets give a black precipitate; the prussiate of potash, a brown; and

* Devergie, vol. ii. p. 754.

† London, Edinburgh, and Dublin Philosophical Magazine, vol. xviii. p. 607. A very delicate process for the detection of copper has been announced by M. Boutigny. It consists in suspending, by means of a hair, the half of a fine needle in the midst of the suspected liquid, previously acidulated with sulphuric acid. The apparatus, thus disposed, is placed under a bell-glass, and allowed to stand for several days. Air-bubbles are found to form on the needle, which gradually burst, and in a few days the copper, if any be present, is precipitated on the steel. The oxide of iron is dissolved in the sulphuric acid, and forms sulphate of iron, which remains in solution. (Edinburgh Medical and Surgical Journal, vol. xl. p. 488; Annales d'Hygiène, vol. ix. p. 228.)

Verguin proposes the following: Place a drop of the suspected liquor on a plate of platina, apply a polished plate of iron, so that it shall touch both the liquids and the platina. In a few seconds the platina will exhibit an adherent covering of copper throughout every part touched by the liquid. (American Journal of Pharmacy, vol. xiii. p. 343.)

ammonia, a very dark brown. Seven parts of the solution of verdigris and ten of wine furnish a fluid with which the above agents produce similar results, except that the precipitate from the ammonia is of a black color. It readily follows, from these, that this alkali is of no use in detecting verdigris if it has been mixed with wine.

If albumen be poured upon the acetate of copper, a bluish-colored precipitate will be obtained. Gelatine produces no effect, whatever may be the temperature of the mixture, and the tests act exactly as if the acetate of copper were alone. Broth furnishes no precipitate, but milk is coagulated by a large quantity of the solution of verdigris, and the coagulum, when properly washed, is of a deep-green color. Sugar, by trituration with verdigris, renders it nearly insoluble in cold water.

Mitscherlich has investigated the action of sulphate of copper on various animal and vegetable substances. With albumen, an excess of this salt forms a bluish-green precipitate. So also, if it be added to caseine. In each of these cases, new compounds are produced, which do not indicate the presence of copper by the usual reagents, and it is necessary in these, as well as in other combinations, which he mentions, to drive off the organic matters, and for this he prefers the process of Christison, to be presently mentioned. It would also seem, that generally a soluble and an insoluble compound are produced by the mutual action of these substances.*

In cases where copper is mixed with animal and vegetable substances, Dr. Christison advises that the suspected matter be first boiled in acetic acid and then filtered. What remains on the filter is to be washed and dried. Test the fluid portion with sulphuretted hydrogen, and boil it to expel the excess of gas. If copper be present, the brownish-black precipitate will be thrown down. This, on being dried and burnt, may be converted into the sulphate by the action of a few drops of nitric acid, aided by heat. Test this with ammonia. The insoluble portion should be heated to redness in a crucible till it

* British Annals of Medicine, vol. i. pp. 751, 817; vol. ii. p. 51.

is completely charred. The copper is reduced to a metallic state, and may be treated with nitric acid, and the liquid tests then applied.

In certain cases, however, no vestige of the poison can be detected, from its having been vomited up during life. Orfila recommends that we should then scrape off the mucous membrane of the stomach and intestines, dry it and submit it to the action of strong heat in a crucible. He has twice, he observes, obtained metallic copper by calcining in this manner a portion of the membranes of two dogs poisoned by verdigris; and this effect particularly takes place when the mucous membrane is of a bluish color, hard and strongly adhering to the substance of the stomach.*

In Dr. Higginson's case, a lancet-blade, dipped in a solution of the poisoned milk, and to which a drop of nitric acid had been added to separate the curd and albumen, was immediately covered with a coating of metallic copper.

Dr. Jackson evaporated a portion of the milk to a spongy mass, and then burnt it in a platina crucible. The ashes were treated with nitric acid. On adding ammonia, a fine blue color, without precipitate, appeared. In another portion of the same, a rod of polished iron was left over night, and the next morning half a grain of metallic copper was scraped from it.

In consequence of some excitement in Flanders and France, relative to the use of sulphate of copper by bakers in making bread, various analyses have been instituted of different vegetable and animal substances, and it is remarkable that several chemists have detected the presence of copper in many of these. Meissner showed that this metal exists in small quantity in many kinds of grain, and hence, that its detection in them is not certainly, or at least always, a proof of adulteration.

Sarzean asserts that he has found traces of it in two hundred species of vegetables, and that it existed in gelatine and in butcher's meat in the proportion of one grain to every fifteen pounds. The quantity in all of these is, however, so minute

* Vol. i. p. 231.

as scarcely to be considered a serious objection to the conclusiveness of an ordinary medico-legal analysis.*

[It has been contended that copper is a normal constituent of the animal body. It is a frequent ingredient of soils, especially those which are ferruginous, in marls and clays.]†

Besides the adulteration of bread, sugar-plums and other articles of confectionary (*bonbons*) have been often colored with the salts of copper, and in consequence, serious disease, and even death, have followed from eating them. Arsenite of copper, (Schéele's green,) sulphate of copper, and chromate of lead, have each been detached by chemists.‡

Lastly, I may mention that the following question has been put to medical jurists: A quantity of food has been found to contain a salt of copper,—was the poison mixed with it while cooking, or was it added after the food had been removed from the pot? It is replied that in the former case, the copper will be found precipitated on the iron. So perfectly did this occur in one case that no copper could be detected in the food, but in its place was sulphate of iron. Devergie, however, suggests that much must depend on the length of time that the poisonous material has been present, and also on the nature of the food. Vegetables, or the presence of an acid, as vinegar, will retard the decomposition.§

Treatment and antidotes. Although vomiting is a common symptom, still it should be freely promoted by the exhibition of warm water, milk, or mucilaginous drinks.

The investigation of M. Marcelin Duval, and the earlier

* British Association, second report, p. 482; Christison p. 415. Boutigny is of opinion that in the cases of vegetables, copper will be found in them only when it is contained in the soil in which they grow. Hence its presence may be considered not as the result of the act of vegetation, but only of absorption. (Edinburgh Medical and Surgical Journal, vol. xl. p. 489.)

† Taylor on Poisons, p. 471.

‡ *Annales d'Hygiène*, vol. i. p. 420, vol. ix. p. 396, vol. x. p. 183. A spoon, made of German-silver, and allowed to stand in a dish of eels cooked with butter and vinegar, recently produced in France all the effects of poisoning with copper, and on submitting the substance on it to a chemical examination, it gave unequivocal evidence of the presence of that metal. (London Medical Gazette, vol. xxiii. p. 655.)

§ Devergie, vol. ii. p. 763.

experiments of Orfila, seemed to prove that *sugar* was the antidote for verdigris. It allayed the pain and other alarming symptoms, and produced a great number of liquid stools. Subsequent researches have, however, diminished the value of this substance. It is useful in calming the irritation when the poison has been expelled by vomiting, but it exerts no chemical action on it, and animals in whom the œsophagus was tied, died, notwithstanding large doses of syrup were administered. When *albumen* was given under similar circumstances, the animal survived several days, experienced no remarkable change, and after death no lesion was found.* Hence it would seem preferable, while sugar, (in large quantities) and milk may be used to aid its operation.

Drs. Milne Edwards and Dumas have also found, in their experiments on animals, that metallic iron is a good antidote. When fifteen, twenty, and even fifty grains of sulphate of copper, acetate of copper, or verdigris, were given to animals, and an ounce of iron filings administered either immediately before or immediately afterwards, the gullet being tied to prevent the discharge of the poison, death did not ensue for five, six, or even eight days, and consequently proceeded from the operation on the gullet; and in one experiment, on the ligature being removed from the gullet, the opening healed up and complete recovery took place.†

The ferrocyanate of potash is also recommended by Dr. O'Shaughnessy as an antidote, from its powers of decomposition.‡

[M. Roucher has found that calcined magnesia completely arrested the symptoms of poisoning by sulphate of copper in the stomach of dogs.]§

* Orfila, vol. i. p. 466. Postal has made some comparative experiments with sugar and albumen, and found that the chances of recovery were as three to two in favor of sugar. He therefore deems it an antidote, and considers it capable of decomposing acetate of copper at the ordinary temperature of the atmosphere—more rapidly, however, at the boiling temperature. (Annales d'Hygiène, vol. x. p. 207; Medico-Chirurgical Review, vol. xxii. p. 528.)

† Christison, p. 424; Medico-Chirurgical Review, vol. ix. p. 611.

‡ Lancet, N. S., vol. vii. p. 838.

§ Gazette Médicale de Strasbourg; Revue Médicale, August, 1851.

The use of vinegar should, in cases of poisoning, be strictly interdicted, since it must prove injurious from its solvent power over the salts of copper.

Should any inflammatory symptoms remain after the presumed evacuation of the poison, they should be treated like gastritis, and opium and antispasmodics may be indicated for the spasmodic affections that are apt to remain.

ZINC.

The *sulphate of zinc*, from its frequent use in medicine, may, by accident, be taken in improper doses. Its property, however, of readily exciting vomiting, will prevent, in most cases, any very serious consequences. In the experiments of Orfila, he found that when given to dogs in large doses, it caused frequent vomitings, but they recovered in a short time. When, however, a solution of it was injected into the jugular vein, violent and often ineffectual attempts were made to vomit, and death followed in a few minutes. So also, when the œsophagus was tied. The animal died on the third day, and on dissection, the mucous membrane of the stomach was found of a deep-red color throughout its whole extent, and black spots were occasionally seen upon the muscular coat from extravasated blood. The lungs were less crepitating than usual, and their color was rather dark.

Cases are also recorded of its effects on the human system. In a female, who by accident drank a solution of two ounces, it produced an excessively astringent taste, a contraction about the throat, burning heat at the stomach, cold extremities, pale countenance, and convulsive pulse. Vomiting, however, soon intervened, and, by the aid of proper remedies, the consequent irritation of the nervous system was subdued. In another case, violent pain in the epigastric region came on, and was succeeded by vomitings and continual stools. These gradually diminished, and he recovered.*

* Orfila's Toxicology, vol. i. p. 270. "A female partook accidentally and very moderately of a cake impregnated with white vitriol, which had been prepared for the destruction of an old man. He was seized with violent vomiting, but the woman died." (Metzger, p. 396.)

From these cases we may consider the following as the chain of symptoms which will result from taking the salt in large doses: "An astringent taste, sense of strangulation, nausea, copious vomitings, frequent stools, pain in the epigastric region, extending afterwards over the whole of the abdomen; difficulty of breathing, frequency of pulse, paleness of the countenance, and coldness of the extremities."

Appearances on dissection. In an unequivocal case of poisoning by it, Mertzdorff found the stomach and intestines, but particularly the latter, contracted, the inner membrane of the stomach grayish green, with several spots of effused blood, and greenish fluid contents, and the inner membrane of the small intestines similarly spotted; the rest of the body quite natural. He detected the poison by chemical tests, not only in the contents, but likewise in the coats of the stomach and intestines.*

Chemical proofs. Sulphate of zinc is very soluble. As usually sold in the shops, it is often very far from pure, having an admixture of the sulphate of iron. This greatly modifies the action of the tests, and it will therefore be necessary to mention their effects, both on the pure and the impure substance.

(a.) The caustic alkalies, when added to the pure salt, throw down a white precipitate, (oxide,) which is soluble in an excess of ammonia; when added to the impure, a greenish-white precipitate. Carbonate of ammonia also precipitates the pure salt white, the impure grayish white.

(b.) The prussiate of potash causes a white precipitate in the pure, and in the impure a deep-blue one.

(c.) Sulphuretted hydrogen, a white precipitate in the pure and impure.

Tincture of galls may be used as a preliminary test, to ascertain the presence of iron; it merely renders the pure salt hazy, but gives a deep-violet coagulum in the other.

When the sulphate is mixed with animal and vegetable substances, Dr. Christison advises that it be acidulated with acetic acid, and filtered. The fluid is then evaporated and treated with sulphuretted hydrogen gas. Expel the excess of gas by

* Christison, p. 452.

boiling, and wash and collect the precipitate. It is then to be dried and heated to redness in a tube. When cool, add nitric acid to it, which acts on the zinc and leaves the sulphur. The nitrous solution must now be diluted and neutralized with carbonate of ammonia, after which the liquid tests will act on it.*

Treatment. We should endeavor to promote vomiting by administering warm water and emollient drinks. Milk is particularly proper, from its power of decomposing the sulphate. We must guard against the approach of inflammation, and allay irritation by anodynes.

Chloride of zinc is said by Mr. Pereira to act in large doses as an irritant or caustic poison, and to affect the nervous system. It produces nausea and vomiting, a burning sensation in the stomach, cold sweats, and convulsions, when taken in large doses.† [The chloride of zinc is sold as a disinfectant, and has caused several deaths.]‡

Oxide of zinc. This can hardly be considered a very deleterious substance. In large doses it produces vomiting in animals, and probably would have the same effect on the human system.§

It is a problem of considerable interest whether *metallic zinc* is a safe substance for domestic utensils. It has been repeatedly recommended for this purpose by individuals on the continent of Europe, but the examinations made by chemists are decidedly unfavorable to it. Proust suggests several

* Christison, p. 447. Orfila, in his last edition, recognizes the variety of effects produced by tests on the pure and impure salt. He only stated the latter (which I copied) in the first.

† London Medical Gazette, vol. xviii. p. 280.

‡ Taylor on Poisons, p. 492.

§ Dr. M. Wendell relates a case where a female took, by mistake for magnesia, thirty grains, two or three times a day, for a fortnight, without any effect, except a slight constriction of the fauces immediately after swallowing the dose. (Coxe's Medical Museum, vol. iv. p. 247. On the other hand, Dr. Busse, of Berlin, mentions of an individual who, without medical advice, took twenty grains daily, until he had consumed 3246 grains. He was wasted and almost idiotical—the abdomen tumid and the skin like parchment, the pulse sixty, and thready. By proper means, he gradually recovered. (British and Foreign Med. Review, vol. vi. p. 221.)

Reill's experiments on animals, with the oxide, are mentioned in the Annals of Medicine, vol. i. p. 171.

objections with reference to its manufacture, such as the effect of heat on it and the difficulty of soldering; but the most important is its facility of oxidation. The atmosphere alone produces this effect, while vinegar dissolves it and forms an acetate.* Several commissions have been appointed in France to examine into the propriety of employing this metal. Vauquelin and Deyeux reported to the medical faculty of Paris that water, when suffered to remain in vessels of zinc, decomposed it, and produced a white oxide. Vinegar caused an acetate, which was ascertained by reagents. Citron-juice and sorrel each produced, on boiling, their respective compounds with the metal. Muriate of soda in solution furnished a liquor which gave a precipitate of oxide of zinc. Lastly, butter heated in a saucepan of zinc destroyed the polish of the vessel, and there was even formed by the heat a small hole in the bottom of it. It is therefore impossible (they remark) to employ it for kitchen utensils without incurring the hazard of its being united, either in the state of oxide or salt, with the viands.†

The French Institute also appointed a committee, at the request of the ministers of the interior and of war, to inquire into the propriety of its use for the fabrication of measures for liquids, and for vessels and utensils for the use of military hospitals. The committee consisted of Portal, Berthollet, Deyeux, Vauquelin, and Guyton Morveau. They repeated several of the previous experiments, with similar results. Even distilled water, heated in a sand-bath, dissolved part of the zinc, and formed a hydrate which possessed a distinct metallic taste.

The commission remark that although the oxide itself may not be dangerous, yet if zinc vessels be used for domestic purposes, we shall have a variety of salts produced from the numerous ingredients that are employed for food. And it is impossible that these can be healthy; nor indeed can it be otherwise but that some will prove noxious. They therefore advise against the adoption of this metal.‡

* See Proust's paper, already quoted.

† Repertory of Arts, second series, vol. xxiii. p. 178.

‡ Ibid., vol. xxv. pp. 247, 313. A third report was made some time previous by Chaussier, Gay-Lussac, and Thenard, on the question whether

With this information on the subject, it is somewhat astonishing that the proposition should be entertained of using vessels made of zinc in dairies. Yet an individual proposed to the London Society of Arts to employ them for obtaining cream from milk. He allows, from his own experiments, that milk subjected to this process is more or less impregnated with the soluble salts of zinc. When asked by the committee of the society what he had done with the milk after the separation of the cream, he replied that he employed it wholly in feeding pigs, and that they thrived on it.*

In this country great efforts have also been made of late years to introduce zinc pans into our dairies. I do not, however, hear of pigs; and it is very probable that the impure milk is distributed for human use. If we cannot call it poisonous, it is at least unhealthy, and should be forbidden.†

canteens of plated zinc were advisable for the French armies. They state, among other results, that common wine, vinegar, and even mixtures of vinegar and water, dissolve the metal and give out hydrogen. The plating of zinc vessels internally with tin has been attempted, but it was abandoned, from the acrid and disagreeable flavor given to the meat; and they add that tin does not appear capable of coating zinc in such a manner as to guard it against the action of acids. Lastly, plates of zinc, when soldered together, have too little solidity, and are apt to give way. They, therefore, gave a decided opinion against the introduction of either plated zinc or tinned zinc for the above purposes. (New York Medical Repository, vol. xvii. p. 88.)

* Method of obtaining cream from milk, by George Carter, Esq. (Repository of Patent Inventions, vol. xv. p. 233.)

† In consequence of the application of zinc plates for covering roofs, the question is beginning to be agitated, whether water passing over them is potable, or, in other words, healthy. Professor Caswell, of Brown University, states that he could find no traces of the metal in water thus coming from zinc roofs, and that, at all events, a very superficial, insoluble oxide will be formed. (Silliman's Journal, vol. xxxi. p. 248.)

The experiments of Boutigny, Chevallier, and Arthaud would lead us, however, to a different conclusion. They will be found in the *Annales d'Hygiène*, vol. xvii. p. 281, vol. xviii. p. 352.

It is stated in the *Pharmaceutical Journal*, vol. iii. p. 537, on the authority of Dr. Elanes, of Berlin, that a solution of sugar, which had stood only a few hours in the summer, in a zinc vessel, contained a considerable amount of zinc salts.

TIN.

In its metallic state, this substance is not poisonous; but a preparation, much used in the arts, is highly deleterious, viz.:

THE HYDROCHLORATE OF TIN.* Three-quarters of a grain dissolved in two drachms of water, and injected into the jugular vein of a small dog, produced a species of catalepsy, which gradually passed into complete paralysis and insensibility, and death followed in twelve hours after the application. Two grains, injected in a similar way, destroyed the animal in fifteen minutes: tetanic convulsions preceded the termination. Lastly, six grains caused vertigo and death in one minute after the injection. On dissection, the lungs were found more or less shriveled, and partially gorged with blood; the blood itself was dark colored, and there was a slight redness of the mucous membrane of the stomach and duodenum. When muriate of tin was introduced into the stomach, it excited violent vomiting and death, without convulsions or paralysis. The mucous membrane of the stomach, on examination, appeared of a dark-red color, was hardened, horny, and, as it were, tanned. It was also ulcerated in various parts, and the intestinal canal contained much black, thick, ropy bile. The lungs were sound.

There are no cases on record, I believe, of death being produced on the human subject by the use of this substance; but from a narrative given by Orfila, as to the effect of a small quantity taken by accident in food, it is evident that it may prove highly deleterious. Colic was produced in all the individuals, and diarrhœa accompanied this in two of them.

Dr. Hazeltine mentions an instance in which a draught of bichloride of tin, prepared for dyeing, was swallowed by a lad. Vomiting ensued, with extrême corrugation of the mouth and fauces. An emetic was given, but the symptoms of reaction became so violent in a few hours as to render bleeding necessary, and this was repeated. Milk and water were con-

* There are two hydrochlorates (muriates) of tin—the protomuriate, and the permuriate.

stantly administered. He recovered, after an illness of a fortnight.*

Among its tests are the following:—

(a.) The addition of corrosive sublimate, in solution, produces a white precipitate.

(b.) The muriate of gold, a purple precipitate.

(c.) Sulphuretted hydrogen, or the hydro-sulphurets, yield a blackish (chocolate-brown, *Ure*,) precipitate, with the protoxide of tin—forming the protosulphuret of tin; while, with the peroxide of tin, they give a yellow precipitate—the bisulphuret.

(d.) The prussiate of potash causes a white precipitate, which soon becomes blue, on exposure to the air.

The action of the muriate of tin on animal and vegetable fluids is very distinct and powerful.

A strong infusion of tea, and the infusion of gall-nuts in alcohol, give an abundant precipitate of a clear-yellow color. A small quantity of the muriate dropped into Burgundy wine produces a violet-colored sediment. Albumen precipitates it of a white color. Gelatine decomposes it, and produces a white, flaky precipitate. Milk is converted by a few drops into thick curds, which, on being dried, are of a yellow color, and friable. Human bile added to it produces flaky curds.

Simple syrup (water saturated with sugar) seems to be the only substance that does not occasion any change in the solution.

These results invalidate the importance of tests, and it is therefore proper in all cases, according to Orfila, to dry the precipitates and calcine them in a crucible with caustic potash. Metallic tin will be produced.†

Antidote. It is evident, from the experiments of Orfila, that *milk* acts as an antidote to this poison. It is completely coagulated, and the coagulum contains muriatic acid and oxide of tin, and is not deleterious. The antiphlogistic treatment

* Boston Medical and Surgical Journal, vol. xxxi. p. 38.

† Most of the tin of commerce, according to Wohler, contains arsenic. The only exceptions found by Sturenburg, were the tin of Banca, and the real English grain tin. The presence of arsenic is detected by Marsh's apparatus. (Journal de Pharmacie, vol. xxv. p. 299.)

may be subsequently necessary, if symptoms of inflammation supervene.*

The *oxide of tin* has also proved destructive to animals who have been made to swallow it.

SILVER.

NITRATE OF SILVER, (*lunar caustic*.) A small quantity of this salt in solution, injected into the jugular, produced difficult respiration, the appearance of suffocation, efforts to vomit, pain, convulsions, and death. On dissection, the lungs were seen of a rose color, the heart was distended with blood, and in one instance, the mucous membrane of the duodenum was of a bright cherry-red. When the œsophagus was tied to prevent vomiting, and twelve grains in the solid form were introduced into the stomach, death followed in six days, without any previous symptoms, except debility, intense thirst, and frequency of pulse. The mucous membrane was perforated in a number of places with small scars of the size of a pin's head. The lungs were, however, sound. Again, twenty grains in solution were administered to a dog, and produced only uneasiness and dejection. On the third day thereafter, thirty-two grains more were given, which caused vomiting of a pulpy matter. Of this he again recovered. On the fifth day the œsophagus was tied and thirty-six grains introduced. It was followed by excruciating pain, and he died on the night of the succeeding day. The examination after death presented the mucous membrane of the stomach dissolved into a pulp, and eschars of a grayish-white color were seen near the pylorus. The muscular coat was inflamed, but the lungs were healthy.

There are but few instances on record of injury done by the nitrate of silver to the human subject. Orfila relates, from Boerhaave, that a student of pharmacy swallowed some lunar caustic, and excruciating pains, gangrene, and sphacelus were the consequences; and Metzger alludes to a case where the most imminent danger followed, from a surgeon letting a

* Orfila's Toxicology, vol. i. pp. 247 to 261.

piece drop into the throat of a patient, whose ulcers he was touching with it. Its effects on the skin are an illustration of its probable operation on the throat, stomach, etc.*

At the Hôpital Saint Louis, in 1839, a patient was brought who stated, after his recovery, that he had swallowed an ounce of the nitrate in solution. The quantity certainly must have been large, as the matters vomited for twelve or eighteen hours blackened the sheets and curtains of the bed. When brought he was insensible, the face and upper limbs were convulsed, the jaws closed, the eyes rolled up, and the pupils dilated and insensible to light. A solution of salt and water was freely given for several hours, when the above symptoms gradually diminished, violent pain in the epigastrium succeeded, for which emollient drinks were substituted. It was not, however, until eleven hours after his admission, that the general sensibility returned and the patient was able to speak. Profound coma, with insensibility, returned at intervals for some days, but he gradually recovered, and was discharged cured on the sixth day.†

Tests. (a.) When thrown on burning charcoal it is decomposed. Vapors of nitrous gas are given out, and the metallic silver remains upon the charcoal.

(b.) The solution stains the skin black.

(c.) Muriatic acid and the soluble muriates precipitate the corneous muriate of silver, which is white and curdled.

(d.) Potash, soda, and lime-water produce a deep-brown precipitate.

(e.) Ammonia when added to a solution of nitrate of silver, forms ammoniuret of silver, and in consequence of the solubility of this new product, the solution is not disturbed; but if the solution of oxide of arsenic be now thrown in, a lively

* Metzger, p. 397.

† American Journal of Med. Sciences, vol. xxvi. p. 239, from Bulletin Général. It is a habit with the apothecaries of France, to keep the fused nitrate of silver in linseed. Dulong has shown that they act on each other, and Deyeux saw a case in which death was produced by the internal use of linseed in which the nitrate had been kept. (North American Medical and Surgical Journal, vol. vi. p. 200.)

yellow precipitate is produced, which on exposure to the air becomes brown.

(*f.*) The hydrosulphates give a black sediment.

(*g.*) Phosphate of soda produces a yellow precipitate.

(*h.*) Prussiate of potash, a white precipitate.

Of these, *c* and *e* are the best tests.

As to the effects of nitrate of silver on animal or vegetable substances, the following may be noticed:—

The alcoholic solution of gall-nuts produces no change.

If ten parts of Burgundy wine be added to one of a solution of nitrate of silver, the fluids become slightly turbid and acquire a violet color. The muriatic acid produces a white precipitate of this mixture, the hydrosulphurets a greenish brown, and the phosphate of soda, violet blue.*

When fifteen parts of an infusion of tea are added to two parts of a solution of nitrate of silver, a flaky precipitate occurs of a deep purple red, bordering a little on black. When one part of nitrate of silver was employed, the mixture was of a yellow color, but passed first to a red and then to a black color, without affecting its transparency. In this state, muriatic acid gave a yellow sediment.

Albumen gives a copious white precipitate, broth a yellowish-white one, and bile an orange-yellow one. Gelatine causes no change. Milk is coagulated; a formation takes place of small white curds, and the fluid becomes transparent.†

Antidote. Muriate of soda appears, from the experiments of Orfila, to counteract the effects of nitrate of silver. It produces an insoluble chloride, which has no power on the system. Hence salt water, aided by emollient and mucilaginous drinks, is advisable.‡

FULMINATING SILVER, according to the experiments of M.

* Chlorine will not answer here as a decolorizing application, since it decomposes the nitrate. (Orfila, London Med. Repository, vol. xiv. p. 509.)

† Dr. R. D. Thomson has made some interesting experiments on the decomposition of the nitrate, by the addition of albumen, or of the mucous secretions of the stomach. Two compounds appear to be formed, one soluble and the other insoluble in water. (Eighth Report of the British Association, Appendix, p. 132.)

‡ Orfila's Christison.

Pagot Laforet, also acts as a violent poison on animals in small doses. But if charcoal, mixed with water, was administered in quantity immediately after the exhibition of the poison, the symptoms ceased and no further injury was sustained.*

GOLD.

NITRO-MURIATE (HYDROCHLORATE now called CHLORIDE) OF GOLD, injected into the jugular of animals produced death apparently by causing suffocation. The succession of symptoms was vertigo, deep respiration, plaintive cries, and occasionally vomiting. They expired in a few minutes after the operation. On dissection, the lungs were seen gorged with blood; the heart was full of black blood, but the mucous membrane of the stomach and intestines was sound.

Death also followed from taking this substance into the stomach; and the mucous membrane was, on dissection, found abraded in several places.

Although Orfila ranks it among the irritant poisons, and Devergie mentions that Cullerier and Magendie saw a dose of from one-tenth to one-twentieth of a grain produce gastrointestinal inflammation, yet it is now stated that Baudeloeque has given the hydrochlorate and stannate of gold, in doses of from ten to twelve grains, to children, without injury, while Velpeau, at La Charité, has given fifteen and even twenty grains during the day.†

Tests. (a.) When thrown on burning charcoal, it is decomposed and converted into metallic gold, and the chlorine is given off.

(b.) It stains the skin a purple color.

(c.) Sulphate of iron produces a brown precipitate, and pellicles of gold are seen floating on the surface of the fluid.

(d.) Muriate of tin produces a purple precipitate.

(e.) The hydrosulphurets cause a deep chocolate-colored precipitate.

* London Medical and Physical Journal, vol. xxv. p. 457; quoted from the Journal Général.

† Devergie, vol. ii p. 786; Lancet, N. S., vol. xxiv. p. 31.

(f.) *The prussiate of potash produces no effect.*

Effects of animal and vegetable fluids. Muriate of gold is not affected by syrup; is precipitated reddish yellow by tea; red, chocolate colored, and afterwards metallic, by tincture of galls; deep purple, and metallic, by Burgundy wine; yellow by albumen and gelatine; and green, passing into purple and violet, by bile. It also instantly colors milk.* Chlorine decolorizes the mixture with wine and leaves the tests to operate in their usual manner.

Antidotes. Dr. Thomson recommends the sulphate of iron for this purpose, from its property of decomposing the salt and throwing down the gold in its metallic state.† Orfila recommends the antiphlogistic treatment generally, and in particular the use of emollient and mucilaginous drinks.

FULMINATING GOLD appears to have proved highly deleterious in several cases quoted by Orfila from Plenck and Hoffman. Vomiting, spasms, diarrhoea, faintings, and death were the consequences of the administration of a few grains, (three to six.) Rivinus mentions having found holes in the intestines of a child poisoned with it.‡

PLATINA.

Twelve grains of the hydrochlorate, when administered to a dog, destroyed it, and violent inflammation of the stomach and intestines was produced; but when applied to a wound in the neck, no effect was produced on the general system or on remote organs.§

* Orfila's Toxicology, vol. i. pp. 288 to 296.

† Annals of Philosophy, vol. v. p. 385.

‡ Orfila's Toxicology, vol. i. p. 297.

§ Gmelin, Edinburgh Medical and Surgical Journal, vol. xxvi. p. 135. According to Dr. Hoeffler, the preparations of platina (chlorides) are poisons: the perchlorides in a dose of a scruple, the double chloride of platina and sodium in the dose of two scruples. They are, however, less dangerous than the salts of gold and corrosive sublimate. The perchloride of platina in concentrated solution produces acute itchings on the skin, followed by a cutaneous eruption in the situation where the solution has been applied. Taken internally, it at first irritates the mucous membrane of the stomach, occasions cephalalgia, reacts on the nervous centres, and thus exercises a

The following may be a case of idiosyncrasy, but it is at all events curious:—

"A person has been uniformly affected with erythema of the face, during the last six or seven years, every time he opens a bottle containing the liquid nitro-muriate (chloride) of platina, within two or three feet distant, and without touching the face. The same effect is produced by opening a bottle containing dry ammonia-oxide of platina. If the smallest particle of these substances be brought into contact with the face, even if the fingers, though they be carefully wiped after touching these preparations, touch the face, the erythema is excited. It spreads rapidly over the skin, feeling very hot, itching extremely, and causing a pale rose-red color. In two, three, or at most, four hours, this slight disease disappears."*

BISMUTH.

Nitrate of bismuth, in its crystallized state, was boiled in distilled water, and the fluid afterwards filtered. When this was injected into the jugular vein, it produced retching, plaintive cries, convulsions of the limbs, palpitation, difficulty of breathing, and general depression, and death. The lungs were dark colored, but tinged only in particular parts, or wrinkled. The left ventricle and arteries contained only a little black blood.

The *subnitrate of bismuth*, on being introduced into the stomach, produced a vomiting of white, ropy matter, deep and difficult respiration, trembling of the limbs, and death. The mucous membrane of the stomach was either highly inflamed or extensively ulcerated, so that the slightest friction separated it in the form of pulaceous scraps. Portions of the lungs were gorged with blood.

When the subnitrate (improperly called *white oxide*†) of bis-

peculiar alterative action on the fluids of the economy. The double chloride does not produce local irritation on the skin. (British and Foreign Medical Review, vol. xi. p. 523.)

* Edinburgh Medical and Surgical Journal, vol. viii. p. 524.

† "There is no such thing as white oxide of bismuth. However much washed, the precipitate obtained by water from the nitrate of bismuth is a sub-salt." (TURNER.)

mouth has not been prepared with sufficient care, it often happens that violent vomiting, diarrhoea, and other unpleasant symptoms will ensue from its administration. In one case where the precipitate produced by adding water to the nitrate did not undergo the repeated washings which are necessary, I have known it to cause the most alarming vomiting.

One fatal case is on record of poisoning by this substance: A man took two drachms by mistake. He was immediately attacked with burning in the throat, vomiting and purging, cramps and intermitting pulse; then with inflammation of the throat; and on the third day, with hiccough, laborious breathing, and swelling of the hands and feet. Suppression of urine had existed from the first, and continued until near his death. This occurred on the ninth day, having been preceded by salivation, delirium, swelling of the tongue, and great enlargement of the abdomen. On dissection, every portion of the alimentary canal, from the throat to the rectum, bore marks of inflammation. The tonsils, uvula, epiglottis, etc., were gangrenous; the gullet livid; the stomach very red, with numerous purple pimples; the whole intestinal canal red, and here and there gangrenous. The inner surface of the heart was red. The kidneys and brain were healthy.*

Tests. (a.) Sulphuretted hydrogen causes a black precipitate.

(b.) The prussiate of potash, a pale yellow.

(c.) Ammonia causes a white precipitate.

(d.) The chromate of potash, a beautiful orange yellow.†

(e.) The tincture of galls, a flaky pale yellow.

(f.) On the addition of water, the fluid becomes milky, and a white precipitate gradually subsides.

(g.) The precipitates, on being calcined with charcoal in a crucible, give out the metal.

Nitrate of bismuth is precipitated pale yellow by tea, yellow by bile, and white by albumen and milk; the last is curdled

* Christison, p. 444; Edinburgh Medical and Surgical Journal, vol. xxxiv. p. 216. The case occurred in Germany.

† So, also, says Dr. Cooper, does corrosive sublimate with chromate of potash.

by it. Gelatine is not affected. Burgundy wine gives a rose-colored precipitate, inclining to violet. The supernatant fluid preserves the red color of the wine; but the hydrosulphurets, on being poured into it, produce a black precipitate.* Ammonia deprives it of its color, without occasioning any sensible white precipitate.

Antidotes. Milk and mucilaginous drinks; and if symptoms of inflammation supervene, the antiphlogistic regimen.†

IRON.

The compounds of this substance are to be deemed among the least poisonous of the metallic salts. There is a diversity of result as to the

Sulphate of iron, (green vitriol.) In the hands of Dr. Smith it proved an active poison. When applied in the dose of two drachms to the cellular texture of the inside of the thigh of two dogs, it killed them in the course of twelve or fifteen hours. On dissection, the internal surface of the stomach of one of them was found covered with a multiplicity of petechial spots; the wrinkles of the rectum were numerous and black; the liver whitish, with livid spots on its convex surface; while the heart contained black grumous blood, and its ventricles had some slight livid blotches.

When introduced into the stomach in the dose of two drachms, it did not destroy life in less than twenty-six hours, and without any other apparent symptom than a general insensibility. The interior of the stomach exhibited red spots; the small intestines presented blackish puffy swellings; and the upper part of the rectum showed red folds.‡

Gmelin, on the other hand, gave it in doses of two drachms to dogs, and it caused nothing but vomiting. Forty grains

* On the addition of chlorine, the mixture is rendered colorless, and the tests produce their ordinary effects. (Orfila, London Medical Repository, vol. xiv. p. 409.)

† Orfila's Toxicology, vol. i. pp. 298 to 307.

‡ Orfila's Toxicology, vol. ii. p. 468; Annales d'Hygiène, tome xlv. pp. 337-382.

had no effect on rabbits, and its injection into the veins was not deleterious.*

Muriate of iron. This is more active, owing to the excess of acid in it. Dr. Christison gives the following case, as communicated to him by Dr. Combe, of Leith: A gardener took an ounce and a half of the tincture of the muriate of iron by mistake for whisky. Pain and tension in the throat and stomach succeeded, with coldness; then a vomiting of an inky fluid, followed by profuse vomiting of mucus and blood, and bloody stools. He rallied under the use of remedies, and in three weeks returned to his occupation; but in two weeks more, Dr. Combe found him emaciated, cadaverous, with pain and costiveness. He died in five days after this. The pylorus was greatly thickened, with a cicatrized patch three inches long, and two inches broad, and another large inflamed spot.†

Probably chalk, magnesia, or soap would act as antidotes to an over-dose.

LEAD.

I cannot too much impress on my readers the necessity of being well acquainted with the symptoms produced by the compounds of this metal, and the tests necessary to detect them. In the course of my remarks it will be seen how often they have produced injurious or fatal effects from being united with very many articles of common food and drink.‡

The principal salts of lead are the following:—

Acetate of lead, (sugar of lead.) There is also a *subacetate of lead*, used most commonly as a medicinal application, under the name of *Goulard's extract*. The distinction between these I shall presently notice.

* Edinburgh Medical and Surgical Journal, vol. xxvi. p. 137.

† Christison, p. 774.

‡ Dr. Bryce relates a case in which three ounces of lead-shot were swallowed, in order to cure a boil. Obstinate constipation and several of the ordinary symptoms of poisoning by lead ensued, nor was the patient relieved until after active purgatives were given for some time, aided by warm enemas, and the warm bath. It was not ascertained that more than one pellet of shot was discharged. (Lancet, N. S., vol. xxxi. p. 498.)

As to the acetate, there are some cases on record of its effects. the following is related by Dr. Kerchhoffs: It occurred in the person of a soldier who drank a considerable quantity of the solution. He was soon seized with the most violent symptoms, indicative of gastric inflammation. A sense of suffocation, drawing in of the belly, costiveness, cold and clammy sweats, and trismus were present. He died in great agony at the end of three days. On dissection, the lead was discovered by proper tests in the fluid of the stomach. The mucous membrane of that organ was abraded in several places, particularly near the pylorus; and the œsophagus, stomach, duodenum, mesentery, liver, and spleen were in a state of high inflammation.*

Dr. Shearman has also observed fatal effects to follow from an adulteration of gin with sugar of lead. The symptoms were, occasional violent colicky pains, chiefly occurring after meals, attended with an obstinate costiveness, and although these were for a time relieved by purgatives and other means, they almost universally recurred. The progress of the disease, he observes, even in those cases where it attained its utmost violence, was in almost every instance so insidious and slow as to leave the observer unapprehensive of its true character, which, however, was at last brought to light.†

Mr. Iliff saw a case where an ounce of the salt in solution had been swallowed through mistake. It produced vomiting and violent pain in the stomach. Sulphate of magnesia, an emetic, and subsequently the stomach-pump, were used. The patient recovered, but she experienced for some days an occasional rigidity of the abdominal muscles and costiveness.‡

Instances are, however, stated, where this salt in quantity has not produced any injurious effects. An apprentice of a cooper,

* Transactions Col. Phys. London, vol. vi. p. 39. The editors of the London Medical Intelligencer, in remarking on this case, observe that they once saw a gentleman die with similar symptoms, after swallowing about three ounces of solution given to him by a quack for an injection. (New England Journal, vol. x. p. 86.)

† Edinburgh Medical and Surgical Journal, vol. viii. p. 213, from Transactions Medical Society of London.

‡ London Medical Repository, vol. xxxiii. p. 37.

near Glasgow, had an ulcer on the tibia, accompanied with considerable inflammation, for which he was ordered a poultice with acetate of lead. As this article is much used by linen-printers, he procured in an adjoining print-field a lump, which could not have weighed less than a pound, being, as he said, of the size of his fist. He laid it on the kitchen table, and shortly after went away. His mistress, an old, short-sighted woman, presently came in with cabbage for the family dinner, laid it on the table upon the lead, without perceiving it, and cut up both with a knife. The lead and cabbage were incorporated into one mass, and the whole was put into a pot, boiled with potatoes, and afterwards chopped together for dinner. This dish was eaten by the master and mistress, their daughter and her husband, and two apprentices. Soon after the lad wished to prepare his poultice, but the materials could not be found. As a curious taste had been observed by all of them in their food, they became alarmed, and on examining the table, it was evident that the sugar of lead and the cabbage had been bruised together, as some of the former, in a powdered state, still adhered to it. Mr. Hunter, of Dumbarton, was immediately sent for. He gave to five of them an emetic, which operated well, and they experienced no disagreeable symptoms afterwards. The sixth person, an apprentice, refused to take anything, as he felt no uneasiness, nor did he subsequently experience any disorder in his bowels.*

It is within the experience of almost every physician, that large doses of this substance have been given as a medicine, without producing any primary or secondary bad effects.†

The diversity that is thus observed has led to some inquiries and investigations concerning its cause. I will first state the result of comparative experiments on animals.

* London Medical and Physical Journal, vol. ix. p. 173. Case by Dr. Hunter, of Dumbarton. Dr. Sigmond, in his Lectures, quotes several similar cases. (Lancet, N. S., vol. xxi. p. 849.)

† See, among many others, Laidlaw's essay on the use of acetate of lead. (London Medical Gazette, vol. iii. p. 721.) Lane, in the Dublin Medical Press, copied in Braithwaite's Retrospect, vol. vi. p. 126; a case in Denmark, quoted in the Medical Times, vol. x. p. 476, and the experience of American physicians generally.

When a solution of the acetate of lead, containing from one to three grains, was injected by Orfila into the jugular of dogs, it did not appear to incommode them. Once or twice only the animals made some slight efforts to vomit, and threw up a small quantity of whitish stringy matter. Five grains did not at first appear to produce any effect; but on the third day the animal became dejected and refused to take food. On the fourth his gait was unsteady and difficult; his posterior extremities occasionally exhibited some convulsive movements, and he was extremely weak. He died on the fifth day, and the lungs and stomach were found healthy. Thirteen grains injected in this way produced instant death without any signs of pain or convulsions. The blood in the left ventricle was fluid, and of a vermilion-red color.

When the acetate was taken into the stomach in a solid form, and in doses of from three drachms to an ounce or more, it excited vomiting, dejection, and death. The mucous membrane of the stomach was inflamed, and spots of a dark color were observed on it; the intestinal canal and lungs were healthy. Its effects, when given in solution, were a loss of muscular power, trembling of the limbs, and vertigo. The mucous membrane was of a gray-ash color.*

Gaspard injected acetate of lead into the veins of animals with fatal effects; and the appearances on dissection were inflammation of the lungs and of the small intestines, but the stomach was generally sound.† Dr. Campbell is also mentioned by Dr. Christison as having proved, by experiment, that death is caused by applying it to a wound. The symptoms were similar to those noticed by Orfila; but the appearances on dissection varied so far, that Dr. Campbell found the stomach red and corrugated, and the small intestines vascular.

Lastly, Dr. Wibmer, a German physiologist, poisoned a dog with sugar of lead, giving daily to the amount of two drachms and twelve grains, in the course of seventeen days. Frequent

* Orfila's Toxicology, vol. i. p. 457.

† London Medical and Physical Journal, vol. xlviii. p. 155, from *Journal de Physiologie*.

vomiting, and gradually increasing weakness, and stiffness of the legs, preceded death.*

All these experiments go to show the direct poisonous effects of the acetate of lead, and at the same time to suggest that the occasional exemption from illness may be owing to accident, constitutional strength, or some fortunate state of the stomach and bowels.

Dr. A. T. Thomson has, however, lately presented some new views on this subject. He is of opinion that, among the salts of lead, the *carbonate* is the only direct poison, and that the seemingly poisonous properties of the other salts depend upon their conversion into this. From his experiments, it appears that the subacetate† and citrate of lead in solution have so powerful an affinity for carbonic acid as to take it from the air; that the affinity of the acetate for this acid is comparatively weak, and that carbonic acid effects no change whatever on the nitrate, muriate, sulphate, phosphate, and tartrate of lead.

Dr. Thomson next proceeded to perform sundry experiments on animals with the three salts convertible into the carbonate. He gave some to dogs, to the amount of several drachms, but without any effect. None of them died. In order to explain the results obtained by Orfila, he suggests that the quantities given were so large as to produce inflammation and death, like any other non-poisonous substance, when administered in excessive doses. On rabbits, the nitrate, muriate, and acetate produced no effect; the subacetate slightly affected the animal, but it was alive a week after taking it. The carbonate, on the other hand, was decidedly poisonous.‡

The deductions to be made from these results are not so positive or comprehensive as Dr. Thompson is inclined to put

* Christison, pp. 486, 487.

† "The subacetate of lead, commonly called *extractum saturni*, is prepared by boiling one part of the neutral acetate and two parts of litharge, deprived of carbonic acid by heat, with twenty-five parts of water." (Turner's Chemistry, fifth edition, p. 799.)

‡ British Association, report of the first and second meetings of, p. 594. The experiments are given in detail in the London Medical Gazette, vol. x. p. 689.

them. His experiments, I apprehend, explain very satisfactorily the diversity of effects induced by the ordinary sugar of lead. As used in commerce, and even by the druggist, it may contain the subacetate.* Other portions may be comparatively pure. And in this manner we may account for the exemption from dangerous symptoms in some cases. We can also grant that the carbonate is among the most active of the compounds of lead. But it is certainly going too far to say that the noxious properties of the compounds of lead depend on the presence of the carbonate alone.†

The experiments of Mitscherlich have added greatly to our knowledge of the action of acetate of lead. A portion of these were undertaken to ascertain the reciprocal decompositions of acetate of lead and the chief animal compounds. The result renders it probable that the oxide of lead unites in different proportions with albumen and acetic acid to form definite compounds, some of which are soluble and others insoluble in water. With milk there is a copious precipitate of casein, and the compound will be almost inert in the stomach, while with salivin and the free acid of the gastric juice, the precipitates are soluble, and of course may prove active. An insoluble compound is formed with mucus, and it is probable that most of the lead introduced into the stomach passes through the intestines in this inert combination. In small doses, the acetate, when applied to a secreting surface, is decomposed, and it is only when the quantity is so large as only to be partially decomposed by the secretions of the stomach that the subjacent organ is attacked and corroded. This corrosion is purely

* The following shows that even the subacetate may be innoxious: "During the campaign in Russia, several loaves of sugar had been inclosed in a chest containing some flasks of extract of lead. One of the flasks having been broken, the liquor escaped, and the sugar became impregnated with it. During the distresses of the campaign, it was necessary to have recourse to this sugar, but far from producing the fatal accidents which were expected, it proved a salutary article of nourishment." (London Medical Repository, vol. xx. p. 441.)

† "The theory that I have advanced is, that there is only one direct poison among the salts of lead, and that the other salts become poisonous only when they are converted into that one." (Dr. Thomson, in London Medical Gazette, vol. x. p. 694.)

chemical, and takes place both in the dead and living animal, though in the latter it is modified by the powers of life favoring the decomposition.

In his experiments on animals, the acetate was introduced into the stomach by means of an elastic catheter. When six or seven doses, of about eight grains each in solution, were given to rabbits, they caused weakness, slow breathing, and death followed in a tetanic paroxysm. The stomach contained an acid yellowish fluid and a small quantity of white insoluble flakes. In each of these lead was detected. The mucous coat was but little affected, and the metal was detected in the fæces. But it could not be found in the blood or urine. This indeed was the result in all his experiments, and he therefore infers that if it passes into them at all, it must be in very small quantities.

In larger doses (nearly three drachms) the pulse was accelerated, there was thirst, difficult respiration, increased fecal and urinary discharges; great weakness and convulsions; and death ensued from three to twelve hours in a tetanic paroxysm. The mucous coat of the stomach was now gray or white, dry, and friable, and easily separated. The vessels of the cellular tissue were gorged with coagulated blood. The whole tract of the small intestines showed similar morbid appearances. If, as sometimes happened, bloody or whitish urine had been voided during life, the bladder corresponded in its changes.

"It appears from the above experiments that acetate of lead produces corrosion of the mucous membrane only when the gastric fluids are not sufficient for its decomposition, and it is rendered probable that the peculiar poisonous action of lead results from the soluble compounds which it forms with the acids of the gastric juice." If this opinion be correct, it would follow that the solution in acetic acid of the precipitate caused by albumen in a solution of the acetate will possess poisonous properties greater than those of the pure acetate, and such was the consequence of experiments with it, both in large and small doses. Death followed more quickly, but the mucous coat of the stomach was in either case corroded.

Symptoms of poisoning from the external application of this salt seldom occur, because there exists no free acid in it to

dissolve the compounds of lead with the organic principles. If death does happen, the result is owing to mechanical and local irritation, and the abdominal viscera are found healthy. But when a solution of the acetate was decomposed by albumen, and the precipitate, dissolved in a slight excess of acetic acid, was injected into the cellular tissue, the symptoms were the same as when introduced into the stomach, as were also the appearances on dissection.*

As to the use of acetate of lead as a medicine, I may be permitted to repeat a remark made in the former edition. I have too often witnessed its value and efficacy in pulmonary and uterine hemorrhages not to feel a great partiality for it as an astringent medicine. I know of nothing that can be substituted, in extreme cases. But I must stop here, and unequivocally condemn the practice which has occasionally obtained of late years, of administering this salt in diarrhoea. It is not necessary at this time to point out the reasons why it must prove injurious; it is sufficient to say that death, preceded by all the symptoms of acute poisoning, has been the consequence of its exhibition. We have the authority of my friend Dr. Mann, late hospital surgeon in the United States army, in asserting that during the war of 1812 several officers of rank fell victims to its use.†

As the chemical proofs of all the preparations of lead are in many respects similar, we shall notice them at the conclusion of this article.

Carbonate of lead, (cerusse or white-lead.) We have a remarkable case on record, of the noxious effects of this substance on the human system:—

Mr. Deering, a surgeon in London, was requested on the 21st of October, 1808, to visit Mrs. R., the wife of a respectable tradesman in Aldersgate Street, who complained of violent pain in the scrobiculus cordis, with great soreness of the epigastric region when pressed upon. She had vomited a considerable

* British and Foreign Medical Review, vol. iv. p. 208; British Annals of Medicine, vol. i. p. 204. Dr. R. D. Thomson, in Lancet, vol. xxii. p. 279.

† New England Journal, vol. xi. p. 19; Boston Medical and Surgical Journal, vol. xxxii. p. 255.

quantity of bilious matter, and at the same time her bowels were constipated; the pulse was calm and regular, the tongue clean and moist, and there was no symptom of fever present. A cathartic was administered, which operated, and an opiate given in the evening. The following morning she appeared relieved; but in the evening the pain and vomiting recurred, and these symptoms continued for some successive days, in so distressing a degree, that it was deemed advisable to consult the family physician, which was done on November 4, 1803. At this time these symptoms continued, as already intimated, without any appearance of fever, and hence the physician was induced to consider the affection as of a rheumatic and spasmodic nature.

In a few days, in consequence of the amendment of the patient, he discontinued his visits. In about a week after this period, a boy in the same family, nearly sixteen years of age, was seized with symptoms exactly similar to those of the preceding case, and similar remedies afforded only partial relief, till at length he was removed into the country, and thereby recovered his health.

A week after the attack of this youth, the eldest child, a boy six years old, was also seized with analogous symptoms, and the mother having relapsed into her former state, the physician was again consulted on the 10th of November. At this time three other persons in the family labored under similar affections, and suspicions were now entertained that some poisonous substance might have caused this general indisposition of the family; but after minute investigation, no one circumstance was discovered to confirm this suspicion, or to elucidate the source of so extensive a calamity.

The sickness and pain continued unabated in Mrs. R., but the son, after the period of a fortnight, was deemed in a state of convalescence by his physician, who discontinued his attendance: he was, however, soon after seized with convulsions, and expired within a few hours. Unexpected and severe as this shock was, Mrs. R. afterwards gradually grew a little better. She had hitherto continued to suckle her child, which, it being fifteen months old, she was advised to wean: to this she reluctantly consented. In about ten days afterwards the child became

somewhat costive, without any other apparent indisposition: but at this period it was seized with vomiting and convulsions, and suddenly expired. The unhappy parent now experienced a return of her complaints, and, under a persuasion of the inefficacy of professional aid, she was prevailed upon to consult an empiric, whose attendance, though continued to the end of the year, proved unavailing; and on the 3d of January, 1809, she had the advice of Mr. Chevalier, an experienced surgeon, who considered the patient's complaint to be chronic rheumatism; and by the use of clysters of warm water, oily mucilaginous medicines, fomentations and vesicatories, she appeared to experience more relief than at any period since the first attack: but although the vomiting and sickness were less violent and frequent, the pain and soreness of the abdomen, first complained of, never entirely subsided; she was, however, able to sit up and amuse herself with a little needlework, and to go about the domestic concerns of the family, and Mr. Chevalier had proposed to pay his final visit on the 21st. On the morning of this day, she rose at ten o'clock, and within the space of an hour afterwards, while standing near the desk of drawers, she suddenly exclaimed, "I am dying!" She was seized with convulsions, which continued till five o'clock in the afternoon, when she expired.

On the subsequent day, Mr. Chevalier, whose anatomical skill is well known, examined the body by dissection. Neither the thoracic and abdominal viscera, nor the brain, upon the most minute examination, exhibited the least appearance of disease; in short, not the least trace could be discovered of any morbid affection.

With respect to the three other persons already mentioned to have been indisposed, the servant-maid, one of them, was conveyed to her friends, and recovered. A sister-in-law of Mrs. R. also recovered; but the third, who was her mother-in-law, died, after lingering under disease till March.

These circumstances having been cursorily communicated to the Medical Society, Dr. Adams, Dr. Hamilton, and Mr. Lawrence were requested to visit the house of this unfortunate family, and to endeavor to ascertain the cause of the calamity.

Every culinary article, and the whole premises were accurately examined, but without leading to any discovery.

It appeared, indeed, that Mr. R., the husband of the deceased lady, had purchased a cask of sugar at a sale, a considerable part of which had been disposed of to some friends in the country, who had used it without inconvenience, and hence no suspicion was entertained of this article having produced the fatality in Mr. R.'s family.

In this state of uncertainty, Dr. Laird, another member of the Medical Society, visited the house; and, on examining the cask which had contained the sugar, he observed a white powder adhering to its inner surface, and which, on being heated by the blow-pipe on charcoal, afforded globules of lead in the metallic state.

The mystery was thus at length developed. The sugar had been carelessly put into a cask which had previously contained white-lead. That part of the sugar which was sent into the country had probably been taken out of the middle of the cask, and had never come in contact with the lead; while that which was used by the family, having been taken from the side, was impregnated with this metal, and doubtless was the source of the fatal events described.

Of nine persons in this family, who were more or less indisposed, four died, and the effects of the poison appear to have been nearly in the ratio of their respective ages.

The infant, fifteen months old, was attacked and expired within the space of twenty-four hours; the child, six years of age, survived a fortnight; Mrs. R., aged forty, lingered three months before the fatal event took place; and the mother-in-law, aged sixty-seven, died four months after the attack.

The symptoms in each were very similar. The vomiting, pain in the stomach, and costiveness, marked the attack of the disease; and the soreness of the epigastric region in those who recovered was not removed by medicine, but seemed rather gradually to wear away by time or change of air. The matter vomited was usually of a dark-yellow color, though sometimes green; the fæces were in general dark colored; but in the case of Mrs. R. they were completely white during the space of twenty-four hours only.

There was a considerable sameness in the medical treatment. The opiates which were given afforded no mitigation of the symptoms, unless joined with cathartics, and aided by fomentations, etc. The countenances of all the patients exhibited a pale, sickly, wan aspect. The pulse in each was slow and regular, rather indeed sluggish, and generally below the natural state; but in no instance were there any symptoms of paralysis.*

I have given the details of this case because it is a most instructive one to the practitioner, as well as the medical jurist. Other instances of the poisonous effects of the carbonate of lead mixed with sugar have occurred in our own country. Thus, at Concord, in New Hampshire, the State Medical Society were requested to examine the cause of general illness in a family. They had suffered under nausea and vomiting for several weeks, accompanied with costiveness, pain, and great weakness. The disease gradually became very violent, and assumed all the appearances of colica pictonum. Suspicion was at length excited, and white-lead was detected in the sugar. One person (a female) died, after having labored under partial paralysis and frequent and violent convulsions.

On dissection, the colon was found contracted in some parts, the gall-bladder filled with bile, and the vessels of the brain turgid. The skin was of a deep yellow. As the appearance of the stomach is not mentioned, it is to be presumed it was healthy.†

Dr. Drake, of Cincinnati, experienced in his own person the effects of its application to an abraded surface. He was severely burnt on both hands, and, among the treatment already used, was wrapping the parts in rags dipped in a painter's solution of linseed oil and white-lead. A real saturnine colic was the result in about four days after its use.‡

* Eclectic Repertory, vol. ii. p. 402, from the Transactions of the Medical Society of London, vol. i., part first.

† New England Journal, vol. xii. p. 256.

‡ Western Journal of Medical and Physical Sciences, vol. iv. p. 51. Dr. Taufflieb relates a case of saturnine colic induced by applying a lead-plaster to a large ulcer. (American Journal of Med. Sciences, vol. xxiii. p. 246.)

Litharge and red-lead. The former is the protoxide of lead in a state of semi-vitrification, and has a grayish-red color; the latter is the duetoxide, and is of a bright red. Both are poisonous. Red wafers, colored with red-lead, are destructive to birds who pick them up, and the same paste is sold for the purpose of destroying beetles, in which it succeeds very effectually. Many toys are also painted with this substance, and thus children have been injured by putting them frequently into their mouths.* Sir George Baker states that twelve infants died successively in convulsions, at Dartmouth, England, in consequence of an ointment, which had litharge in its composition, being applied to the nipples of their nurses.† Dr. Charters relates of a Fakeer, in India, who administered to two soldiers six drachms of litharge in divided doses. The result was a very violent colica pictonum.‡

The muriate of lead, (oxychlorate of lead, Turner's yellow, or patent yellow,) is also very poisonous, according to Dr. Paris.

Action of air and water upon lead. It was noticed as early as the days of Cæsar and Augustus, by the Roman architect Vitruvius, that cerusse was formed on this metal by water passing over it, and he therefore forbade its use for water pipes.§

Chemical investigations in later times have proved the correctness of this opinion, and the only question has been, in what condition it is present, and under what circumstances it is most freely produced. The following may be taken as the present state of our knowledge:—

Lead exposed to the *air* becomes tarnished, and the crust thus formed is a carbonate. It will be produced most rapidly if the air be moist. As to the action of spring waters, Dr. Lambe was of the opinion, from his experiments, that they possessed the power of dissolving and corroding lead to such an

* Paris, *Medical Jurisprudence*, vol. ii. p. 352.

† Transactions of the College of Physicians of London, vol. iii. p. 243.

‡ Transactions of the Medical and Physical Society of Calcutta, vol. v. p. 155. Symptoms of poisoning by litharge are not uncommon in Denmark, as the peasants use it to sweeten their sour beer. (*London Medical Gazette*, vol. xxv. p. 375.)

§ Christison, p. 459.

extent as to render them dangerous to man. Dr. Thomas Thomson, on the other hand, while he assented to the opinion of their acting on lead, nevertheless maintained that the metal was only held in suspension, and not in solution, and that the quantity suspended in such waters, after they had passed through lead pipes, pumps, or cisterns, is far too minute to prove injurious. Dr. Christison, in order to reconcile, if possible, these discrepancies, performed a series of experiments. He found that *distilled* water, deprived of its gases, and excluded from contact with the air, had no action whatever on lead. If this water contains the customary gases, (*pure rain or snow water*,) the surface of the metal soon becomes white, but this soon ceases if the surface of the water be not exposed to the air. In that case and if the air has free access, a white powder soon forms around the lead, and this increases until, after a few days, a large number of white pearly scales are produced, which partly float in the water, but are chiefly deposited in the bottom of the vessel. These scales are, on analysis found to be a carbonate. He also ascertained that during this experiment a very minute quantity of lead was actually dissolved in the water.*

Our common spring and river waters, (*hard water*,) however, contain more or less of neutral salts; and to make the inquiry practically useful it becomes necessary to ascertain their influence in promoting or impeding the action on the lead. Guyton Morveau found that if he added a solution of either sulphate of lime or muriate of soda (salts very common in spring water) to distilled water, its power of attacking lead was destroyed. Dr. Christison extended this investigation to many other salts, and found that they all impaired the power of the water; and that even when the carbonate was formed in very minute quantities, it was deposited so slowly and adhered so closely to the lead that it could hardly be supposed to diffuse itself through the liquid.†

In a second paper on this subject, published in the Transactions of the Royal Society of Edinburgh, vol. xv., Professor Christison has given the results of his matured and confirmed observations in the following conclusions:—

* Christison, p. 460.

† Ibid., p. 462.

1. Lead pipes ought not to be used for the purpose, at least where the distance is considerable, without a careful chemical examination of the water to be transmitted. 2. The risk of a dangerous impregnation of lead is greatest in the instance of the purest water. 3. Water which tarnishes polished lead when left at rest upon it for a few hours cannot be safely transmitted through lead pipes without certain precautions. (Conversely, it is probable, though not proved, that if polished lead remain untarnished, or nearly so, for twenty-four hours, in a glass of water, the water may be safely conducted through lead pipes.) 4. Water which contains less than about an 8000th of salts in solution cannot be safely conducted in lead pipes, without certain precautions. 5. Even this proportion will prove insufficient to prevent corrosion, unless a considerable part of the saline matter consist of carbonates and sulphates, especially the former. 6. So large a proportion as a 4000th, probably even a considerably larger proportion, will be insufficient, if the salts be in a great measure muriates. 7. It is, I conceive, right to add, that in all cases, even though the composition of the water seems to bring it within the conditions of safety now stated, an attentive examination should be made of the water after it has been running for a few days through the pipes; for it is not improbable that other circumstances, besides those hitherto ascertained, may regulate the preventive influence of the neutral salts. 8. When the water is judged of a kind which is likely to attack lead pipes, or when it actually flows through them, impregnated with lead, a remedy may be found either in leaving the pipes full of the water, and at rest for three or four months, or by substituting for the water a weak solution of phosphate of soda in the proportion of about a 25,000th part.

Capt. Philip Yorke has examined the subject, and also performed a number of experiments on the action of distilled and spring water. His results in the main correspond with those of Dr. Christison, and he supposes that, besides the carbonate, a hydrated oxide of lead is formed, soluble in the water.*

* London and Edinburgh Philosophical Magazine, vol. v. p. 81; vol. xxviii. p. 17. Bousdorff has confirmed these results and found the oxide

Again, Mr. Alfred S. Taylor, in a series of experiments, continued for seven years, has verified the results of Dr. Christison in a most satisfactory manner. He found that distilled water, perfectly pure, when exposed to the air, acted on lead immersed in it, and slowly formed a precipitate of carbonate of lead; while the water, on being tested, gave faint traces of the metal. But if the distilled water *was not perfectly pure*, it prevented the formation of the carbonate. Of all the salts added by him to distilled water, he found those which are most common in hard water (as sulphate of lime) to be most effectual, in preventing action on the lead.*

With these facts, it will not be difficult to answer the question, whether it is safe to carry water over lead, or to collect it in cisterns lined with lead. The probability certainly is, that a portion of carbonate of lead is either dissolved or diffused through it, and renders the liquid measurably deleterious; and we have abundance of accounts to illustrate this opinion. Lead colic was unknown at Amsterdam until the metal was substituted for tiles on the roofs of dwelling-houses; it then raged with great violence. Dr. Yeats, in a paper on the waters of Tunbridge Wells, mentions that in 1815 lead colics were very frequent at that place. A Mr. Taylor had laid down, in 1814, several thousand feet of leaden pipes, to convey water to the different houses. In the following year, the lead colic occurred in those houses to which this water was distributed; and all doubt as to the existence of the poison in it was removed by the examinations of Dr. Lambe and Mr. Brande. They detected the carbonate, in a very minute state of division, in the water.†

A somewhat similar case is related of officers on board a

produced by the action of water containing air, to be perfectly soluble in water—one part of lead in 7000 of water. (*Lancet*, N. S., vol. xxi. p. 453.)

* *Guy's Hospital Reports*, vol. iii. pp. 60 to 91. See also *Pharmaceutical Journal*, vol. ii. p. 409; Mr. Scanlan, in *ibid.*, vol. iv. p. 69; Dr. Dana's *Analysis of water passing through leaden pipes at Lowell*. (*Boston Medical and Surgical Journal*, vol. xxviii. p. 326.)

I am aware that Professor Horsford, in his elaborate paper on "Service Pipes for Water," comes to a different conclusion, and also that the popular opinion is in favor of the innocuousness of leaden pipes, because *no injury has happened*. That it *may happen*, is, I think, shown conclusively.

† *Brande's Journal*, vol. xiv. p. 352.

packet bound to the East Indies. They put their allowances of water in a leaden cistern, furnished with a stop-cock; and in about three weeks every one of them was affected with all the symptoms of colica pictonum in the most violent degree. On arriving at St. Helena they gradually recovered.*

It is an evident deduction from the researches of Dr. Christison, that in proportion to the purity of the water and the presence of carbonic acid will be the action on the metal.†

Different articles of food or drink may be contaminated with this substance.

If the *food* contain any free vegetable acids or saline preparations, it will attack utensils made of lead, and oxidate, and

* Medical Commentaries, vol. xix. p. 180. The presence of lead in the water was demonstrated by the application of a solution of sulphuretted hydrogen. Additional cases of the injurious effects of water impregnated with lead may be found in the Transactions of the College of Physicians of London, vol. ii. p. 419, etc.; also, in Medico-Chirurgical Transactions, vol. xxii. p. 82; cases by Dr. Alderson, of Hull. Mr. Pearsall, who examined the water in these last, obtained first water clear and pure from the cistern, but on agitating it, and drawing off equally bright water the next day, it gave unequivocal proofs of the presence of lead. (Chemist, vol. iii. p. 273.) Mr. Osborn detected lead in water taken early in the morning, and which had thus stood in the pump for several hours. Dr. De Mussy, in Dublin Quarterly Med. Journal, vol. vii. p. 405, relative to the poisoning of Louis Philippe and his family at Claremont. See also an account of the poisoning of the dogs in Queen Victoria's kennel, at Ascot, by water thus impregnated. (Chambers' Journal, 1843, p. 112.)

The *dry bellyache*, so common in the West Indies, has been ascribed by some to the water passing over painted roofs, and then being collected in tanks. See London Med. Gaz., vol. xi. pp. 78, 795, 873.

† In the water of the River Thames, though it flows in leaden pipes, no lead can be detected; and this may be explained by the fact that the animal matters which constantly accumulate in it prevent any dissolution or suspension of the metal; they combine with it, and form a bulky insoluble precipitate. "If you add nitrate of lead to Thames water, you will find that it becomes milky, and that a white powder falls to the bottom, which dissolves without effervescence in nitric acid; it is, therefore, a combination of oxide of lead with some animal matter. Thus it is the impurity of Thames water that prevents it from containing lead. Probably hard waters, containing sulphate of lime in solution, may also be free from lead. But with these exceptions, we may lay it down as a general fact, that all waters which pass through leaden pipes, or which are kept in leaden cisterns, contain small particles of carbonate of lead." (Dr. T. Thompson, Edinburgh Med. and Surg. Journal, vol. xii. p. 495.)

indeed in some cases dissolve them. This circumstance seems to have been known to the ancients. Their tin was all adulterated with lead; and Galen, assigning this as a reason, cautions against the use of tinned vessels, and recommends the preservation of medicines in glass ones.*

Earthen vessels, glazed with lead, are also very apt to be acted on by vegetable acids. Vinegar corrodes them, and if there be any particle of food within, the oxide or acetate that is produced will mix with it;† so also weaker acids. A case occurred some years ago at Northampton, Mass., where a family, consisting of eight individuals, were all seized with colicky pains, strong convulsive spasms of the intestines, frequent vomitings, and obstinate costiveness, in consequence of eating stewed apples which had been kept for some months in a large earthen vessel. On examination, the glazing was found corroded, and a solution from the stewed apples exhibited the chemical proofs indicative of the metal.‡ Dr. Eberle also states that he saw four cases in 1815 arising from apple-butter being in these vessels. On examining one of them, a thin crust of acetate of lead was seen covering its internal surface.§

* Beckmann on Inventions, vol. iv. p. 29. The question has sometimes been asked, whether the sheet-lead which is wrapped round the tea obtained from China, may not prove injurious? Dr. Thomson has satisfactorily determined this point. He found it, on analysis, to consist of lead 95.5 parts, and tin 4.5 parts in the hundred. This alloy is not so liable to tarnish as pure lead, and it possesses this peculiar advantage, that when it comes in contact with articles of food, the tin is always acted on in preference to the lead. (Annals of Philosophy, vol. iv. p. 155.) Proust established the fact just mentioned, by numerous experiments. See his paper on Tinning, copied from the Journal de Physique, in the Repertory of Arts, second series, vol. ix. pp. 38 and 145.

† Transactions of the College of Physicians of London, vol. i. p. 257, etc.

‡ An account of the poisonous effects of the use of glazed earthen vessels, by Dr. Meade. (New England Journal, vol. ii. p. 255.) A similar case is related in *ibid.*, vol. xii. p. 253. The apple-sauce, when made, is turned hot into these pots, and the glazing is readily acted upon. In the present instance, nearly one-third was found decomposed. A case from eating pear sweetmeats, kept in a similar way, in Boston Medical and Surgical Journal, vol. xvi. p. 239.

§ American Medical Recorder, vol. i. p. 534. See also a paper on the danger of using vessels of lead, copper, or brass in dairies, by Mr. Thomas Hayes, surgeon, Hampstead, in the Repertory of Arts, first series, vol. vii. p. 116.

Milk has also acted on vessels of this description.

The adulteration of *wines* by lead appears to be an old device; and it has been much used, since it destroys their austerities, gives them a sweet taste, and renders them salable.

Beckmann supposes that the ancients were acquainted with the fact that lead rendered harsh wine milder, for Pliny remarks that when the Greek and Roman wine merchants wished to try whether their wine was spoiled, they immersed in it a plate of lead, which could only be to observe whether by corrosion the color of the lead was changed.

It was not until the fifteenth century that the use of lead in wines became so notorious as to call for prohibitions on the part of governments in Germany; and the adulteration of this article appears to have been a subject of deliberation at the Diet of Rothenburg, in 1487, and the Diet of Worms, in 1495.* In France, this species of villainy was carried to a great excess. The Duke of Wirtemberg, by a decree dated March 10, 1690, declared it capital to mix litharge in wine, or even to sell litharge in shops;† and individuals were punished with death for the infraction of this decree. At the present day we have every reason to believe that sugar of lead is frequently employed by unprincipled dealers.‡

Cider, adulterated by lead, has also frequently proved injurious, and indeed to such an extent that the disease known by the name of the *Devonshire colic* has been deemed to originate from this cause. I am aware that other causes have been assigned, but it is sufficient for my present purpose that this fluid, among others, has excited the symptoms in question; and it is certainly well established that cider boiled in leaden vessels has produced death to those drinking it, and that the racking of it in a leaden cistern, or even the grinding of the apples in troughs which are united by lead has been the origin of serious illness.§

* Beckmann on inventions, vol. i. p. 396.

† Transactions of the College of Physicians of London, vol. i. p. 346.

‡ Thirty-two cases occurred in the Duke of Newcastle's family, in Hanover, in 1752, occasioned by their using, as a common drink, a small white wine adulterated with calces of lead. (Dr. Warren, Trans. College Physicians of London, vol. ii. p. 86.)

§ See the papers of Sir George Baker and Dr. Warren, in the Transactions

In 1842, six individuals in France, after drinking cider for a few days, were seized with the usual symptoms of poisoning by lead, as violent colic, obstinate constipation, pains in the limbs with the attendant trembling. They recovered under the usual remedies. Messrs. Chevallier, Ollivier, and Pages were directed to inquire into the mode in which the cider had become adulterated, and they found that, during its preparation, it had been allowed to remain for two days in a reservoir which was lined with lead. They also recognized that the salt of lead was a malate, which they found to be soluble; although Thomson asserts that malic acid exerts no action on lead, and Berzelius states that malate of lead is nearly insoluble in cold water. It is possible that the sugar, gum, and vegetable albumen, etc., in the cider, may aid the action of the acid. The individual who had sold the cider was fined for want of due precaution.*

Rum is another liquor which may act on lead. Dr. John Hunter mentions that a violent colic prevailed extensively among the soldiers at Jamaica in 1781-2. They were in the habit of drinking rum; and suspecting its purity, he was led to examine it. The result of his experiments induced him to believe that it was contaminated with lead.† Dr. Franklin also communicated a curious fact to Sir George Baker on this point. About forty years previous, (Sir George's paper was read in 1767,) leaden worms were used in Boston for the distillation of rum. The consequence was so violent to drinkers, and the illness so common, that government forbade their use, and ordered the worms to be constructed of block-tin. The dry bellyache was much less heard of afterwards.‡

of the College of Physicians of London, vols. i., ii., iii.; London Med. Gazette, vol. x. p. 814.

* Annales d'Hygiène, vol. xxvii. p. 104. See also cases by Dr. Shipman, in American Journal Medical Sciences, N. S., vol. vi. p. 89.

† Transactions of the College of Physicians of London, vol. iii. p. 227; Medical Commentaries, vol. xiii. p. 138. When the new rum in the West Indies, thus impregnated, has been kept in a cask for twelve months, it loses its deleterious qualities. This fact is mentioned by Mr. Sylvester, and by him applied to the discovery of a new test—the gallic acid. (See Eclectic Repertory, vol. iv. p. 454; Paris' Medical Jurisprudence, vol. ii. p. 342.)

‡ Transactions of the College of Physicians of London, vol. i. p. 286.

Even *syrups* have been clarified by the acetate of lead, and thus contain a notable portion of the metal.*

Cheese has sometimes been colored with red-lead; and several cases are on record of families being poisoned by its use. In one instance, a dog, who had eaten the rind, was convulsed, and died in a day.†

Sugar, apart from the actual intermixture of a salt, has been contaminated by lead. A remarkable instance has occurred in our own country, at Calais, in the State of Maine. Nearly one hundred persons were almost simultaneously seized with violent colicky affections; out of that number three died, and several remained extremely ill—many suffering also under paralysis of the extremities. On examination, it was found that all who used sugar obtained from a certain mercantile house, were ill, and none other. This led to a chemical investigation by Dr. Charles T. Jackson, of Boston, and he demonstrated the presence of lead. The sugar, in this instance, came from Barbadoes; and Dr. Jackson suggests that probably leaden reservoirs were used in preparing the syrup, and that the free acids of the juice acted on them.‡

Mr. Schweitzer states that lead is often found in English *chemical* preparations, and assigns as a reason that alkalies, acids, and salts act on the white glass of that country, which contains more or less of lead. He appears to have detected its presence in many instances.§

Saturnine emanations are well known to produce dangerous disease; and these, of course, most readily affect workers in lead, as plumbers, painters, type-founders, printers, and potters. I shall not, however, enter on this subject at present, as it can hardly, if ever, be a subject of legal investigation, and particularly because it can be examined with most advantage

* Orfila's Toxicology, vol. i. p. 454. The same salt was detected by Labarraque and Pelletier in the orange-water sold in Paris in 1829, (*Annales d'Hygiène*, vol. iv. p. 55;) and by Mr. Squire, in that sold in London, (*British Annals of Medicine*, vol. i. p. 15.)

† American Medical Recorder, vol. vii. p. 600; Dr. S. W. Williams, in Boston Medical and Surgical Journal, vol. xiii. p. 58.

‡ Boston Medical Magazine, vol. iii. p. 716.

§ London and Edinburgh Philosophical Magazine, vol. viii. p. 266.

when we treat of the *diseases of manufacturers*, in the part relating to MEDICAL POLICE.*

It will be proper, however, to give a short sketch of the symptoms produced by the gradual introduction of small quantities of lead into the system, to illustrate the effects of adulterated food and drink, also of those produced by emanations, or by working in the metal.

Colic is among the earliest symptoms; and from this circumstance the complaint was, for a length of time, styled *colica pictonum*. It is not acute at first, nor of long duration, but frequently returns, and at last becomes intolerably severe. The mouth is dry; there is generally an absence of fever; sickness of the stomach is present, and sometimes vomiting, which will last for several days. The abdomen is drawn inward toward the navel; and this sinking in is the more observable as the pain becomes more intense. Costiveness is very common, and the alvine excretions are discharged with pain and difficulty. The urine presents no particular character.†

* I, however, insert the following:—

Dangerous effects produced by the bleaching of lace. In the process of manufacture, Brussels lace is liable to become soiled. If it were washed, its value would be reduced; hence the so-called bleaching of this lace is effected by impregnating the fibre with carbonate of lead. M. Blanchet has recently communicated to the Academy of Sciences some cases, in which he had observed that the workmen engaged in this manufacture suffered from an impairment of the senses of vision and hearing. The disease presented all the characters of saturnine paralysis. He visited the manufactory, and ascertained that the lace, covered with the finely-powdered carbonate of lead, was well beaten between sheets of paper. The workmen thus breathed an atmosphere constantly impregnated with the poison. The cause of the symptoms was at once explained.

M. Chevallier had previously called the attention of the French government to the subject. He observed that the workmen were liable to suffer from *colica pictonum*; and suggested that the disease might also appear as a just retribution in those females who were in the habit of wearing lace, so whitened, in contact with the skin. (London Med. Gazette, December 24, 1847.)

There is a case of poisoning from *flour* containing lead, in Edinburgh Monthly Journal Med. Science, vol. i. p. 220; from *maccabi snuff*, adulterated by red-lead, causing disease and probably death, in London Med. Gazette, vol. xxxii. p. 138; and from *lead-shot* remaining in a bottle of liquor, in Lancet, vol. xxxiv. p. 129.

† Dr. Burton, of St. Thomas' Hospital, has, in repeated instances, noticed

Paralysis of the fingers, hands, and wrists is also a frequent accompaniment of this disease, and it occurs most severely in those who are in the constant practice of handling preparations of lead. Convulsive motions, prostration of strength, a dry cough, and a gradual wasting, generally attend this stage of the complaint.

It has been observed by some writers, that the appearances found on dissection in those who have fallen victims to saturnine emanations, are strongly indicative of disease—exhibiting inflammation or obstruction of the mesentery and its glands: affections of the liver, spleen, and lungs, and inflammation of the intestines. Most of these are, however, contradicted by modern examiners, and it is denied that, in general, any inflammation is found in the digestive canal. A contraction of the diameter of the great intestines, particularly of the colon, is the only morbid appearance that was noticed in numerous dissections.*

Chemical proofs. A multiplicity of tests have been proposed for the detection of the acetate, or any other of the soluble salts of lead. I shall follow Dr. Christison in stating some of the most unequivocal:—

(a.) Sulphuretted hydrogen causes a black precipitate, the sulphuret of lead. This is a very delicate test. It is, however, possible that water containing the metal may, in passing through a filter, be nearly deprived of the whole of it. A second filtration, according to Mr. Pearsall, will sometimes

a peculiar appearance of the gums in those who have been slowly affected by the introduction of lead into the system. The edges, (of the gums,) where they were attached to the necks of two or more teeth, were distinctly bordered by a narrow line of a *lead-blue* color, while the remainder of the gums, for the most part, retained their usual color and condition. Salivation he considers as a very rare occurrence from the absorption of lead. (Medico-Chirurgical Transactions, vol. xxiii.; British and Foreign Medical Review, vol. x. p. 427; vol. xi. p. 450.) Several continental physicians have noticed the same appearance. I observe that the credit of its discovery is claimed for Tanquerel.

* Among later writers on *colica pictonum*, I may refer to Dr. Stokes' Lectures, Dublin, and Copland's Dictionary. Mr. Dunn, a manufacturer of white-lead, detected the metal in the atmosphere of his manufactory. (London and Edinburgh Philosophical Magazine, vol. vii. p. 77.)

remove almost every trace. To prevent any mistake, add sulphuretted hydrogen to the filter also.

(b.) Chromate of potash gives a beautiful canary-yellow precipitate, the chromate of lead.

(c.) Hydriodate of potash causes also a beautiful yellow precipitate, the iodide of lead. If, however, an excess of nitric or acetic acid be present, these acids will cause a yellow coloration, even though there be no lead in the solution.* It is important to use each of these tests, since sulphuretted hydrogen produces a black precipitate with other substances.

(d.) If the solution of lead be not too diluted, a piece of zinc suspended in it for some time will produce the usual crystalline arborescence.†

(e.) Sulphate of soda. This is recommended by Dr. T. Thomson as a very minute and unequivocal test. It will produce a white precipitate in water containing one hundred thousandth of its weight of lead. "The precipitate," says Dr. Thomson, "is a fine dense powder, which speedily falls to the bottom, and is not redissolved by nitric acid; no other precipitate can be confounded with it, except sulphate of barytes, and there is no chance of the presence of barytes in solution in water.‡

The minuteness of the various tests will be seen in the following table:—

	Parts of water.
Sulphate of soda detects one part in	5,000
Hydriodate of potash	10,000
Ferrocyanate of potash.....	18,000
Potash	20,000
Carbonate of potash.....	60,000
Carbonate of soda.....	60,000
Chromate of potash.....	100,000
Sulphuretted hydrogen.....	500,000§

* To prevent any uncertainty with this test, Mr. R. Johnson has recommended the following modification: Dissolve the sulphuret obtained by (a) in the nitric acid; add carbonate of soda; dissolve the precipitated carbonate of lead in acetic acid with a gentle heat. To this acetic solution, add the hydriodate, and the characteristic color will be produced. (Lancet, N. S., vol. vii. p. 671.) † Christison, p. 456.

‡ Paris' Medical Jurisprudence, vol. ii. p. 363.

§ Devergie, vol. ii. p. 779. Harting states that chromate of potash will detect 1-70,000th, and sulphuretted hydrogen 1-350,000th.

The discrepancy between Drs. Devergie and Thomson, as to the sulphate of soda, is very striking. The former, however, insists on his correctness, and therefore prefers the chromate of potash in all minute investigations.

The reduction of the sulphuret may be accomplished by putting it into a small hole scraped in a piece of charcoal, and applying the flame of the blow-pipe to it. The metal almost immediately appears. If any doubts exist as to its nature, the charcoal may be withdrawn, and the flame again applied, "when two beautiful concentric circles of red and yellow remain, being the yellow and red oxide of lead."

Insoluble matters may be evaporated to dryness, and burnt in a crucible; but, generally speaking, nitric acid will dissolve the lead from most of its compounds that are insoluble in water.*

It would appear from a series of experiments on animals by Orfila, with the salts of lead, that even after a fortnight or more, the metal may be detected in its state of combination with the tissues of the digestive canal. The parts should be boiled for half an hour in diluted nitric acid, and a copious product of nitrate of lead is attained.† Dr. Budd (*Medico-Chirurg. Transactions*, vol. xxv.) states that lead has been detected in the muscles paralyzed by it, and it is also asserted that traces have been found in the brain.‡

Dr. Charles T. Jackson used the following process in examining the suspected sugar: Five hundred grains were burnt to cinders in a platina crucible, and these cinders again to ashes in a capsule. The ashes were digested with nitric acid, and then evaporated to dryness. They were then treated with water, and filtered. A current of sulphuretted hydrogen was now passed through it, which produced the black sulphuret of lead. This, when collected and dried, weighed 1.6 gr.=1.38 gr. of metallic lead = 2.337 grs. of oxide of lead, or nearly 38 grs. of oxide of lead in one pound of sugar.

Antidotes. From the experiments of Orfila, it appears that

* Christison, p. 483; *Lancet*, N. S., vol. vii. p. 386.

† *Annales d'Hygiène*, vol. xxi. p. 166.

‡ *London Medical Gazette*, vol. xxix, p. 413.

the sulphates of soda and magnesia are the most useful remedies against the noxious effects of the salts of lead. They decompose the acetate in particular, and transform it into an insoluble sulphate of lead, which Orfila considers innoxious.* The phosphate of soda is also an antidote. He recommends the same treatment for the other preparations. We should aid their operation by diluents and purgatives, and prevent any tendency to inflammation by the antiphlogistic treatment.†

The treatment of colica pictonum does not require a notice in this place.

The sulphuret of potash should never be administered as an antidote, since it is (as we have already shown) itself a poison.‡

Iodide of lead. This, from some experiments of M. Paton, would seem to be a poison. He gave twenty-four grains to a cat, which, after some hours, produced violent colic, and apparently great suffering. It died on the third day, but on dissection no traces of irritation could be found. He could not detect the poison in the fluids of the stomach. The contents of the intestines were then boiled with distilled water, and decolorized with carbon; but on this reagents induced no change. The residuum was then boiled in water, acidulated with nitric acid; and on adding a solution of chromate of potash, chromate of lead was thrown down. Further experiments produced all the phenomena of the soluble salts of lead.§

Dr. A. T. Thomson observes that the iodide of lead is soluble

* This, however, is not positively certain. (See *Pharmaceutical Journal*, vol. ix. p. 434.)

† In a case by Mr. Cross, in which six or eight drachms of cerusse had been accidentally taken, and was producing excruciating colics, with paralysis of the extensor muscles, sulphate of magnesia combined with a portion of sulphuric acid proved successful in relieving the illness. *Lancet*, N. S., vol. xxiii. p. 786.) Liebig has recommended sulphuric acid lemonade, a solution of sugar rendered acid by sulphuric acid, as an antidote and preventive of colica pictonum.

‡ For an account of the prophylactic and curative powers of *Iodide of potassium* in cases of impending or actual lead poisoning, suggested by Dr. Melseus, see *British and Foreign Medico-Chirurgical Review*, January and April, 1853; cases corroborative of the experiments of M. Melseus, *New York Journal of Medicine*, September, 1853. Its efficacy is questioned in the *Lancet*, December, 1853.

§ *British Annals of Medicine*, vol. i. p. 272.

in boiling water, and is deposited, on cooling, in very brilliant golden-colored scales. A small portion only remains in solution. To this, when cold, add mucilage of starch, and pour on the mixture chlorine gas, or drop it into nitrous acid. In the one case, iodide of amidine and chloride of lead will be formed; and in the other, iodide of amidine and nitrate of lead.*

CHROME.

Several of the compounds of this metal are coming into extensive use in the arts, and their effects both on man and animals are found to be extremely active.

Professor Gmelin, of Tübingen, performed numerous experiments with the chromate of potash. When one grain was injected into the jugular vein of a dog, it produced no effect. Four grains induced constant vomiting, and death in six days, without any distinct symptoms except weakness, and without any obvious morbid appearance. Ten grains caused instant death by suddenly stopping the action of the heart.

When introduced under the skin its effects are still more remarkable. It seems to cause general inflammation of the lining membrane of the air-passages. Thus, when a drachm in powder was inserted under the skin of the neck of a dog, the symptoms were want of appetite, vomiting, a purulent matter discharged from the eyes, palsy of the hind legs, difficulty of swallowing, and death on the sixth day. On dissection, the wound was seen not much inflamed, but the larynx, bronchiæ, and ramifications of the air-tubes contained fragments of fibrinous effusion, and the nostrils were full of similar matter.†

According to Berndt, the bichromate is probably more active than the chromate, but their effects are very similar. Ten grains of the former, when swallowed by a pigeon, destroyed it in four hours; and four grains to a young dog shortly induced vomiting and great weakness, but the animal recovered.

* *Lancet*, N. S., vol. xx. p. 708.

† *Edinburgh Medical and Surgical Journal*, vol. xxvi. p. 133.

Whether taken into the stomach or inserted under the skin, the brain, spinal marrow, and lungs were found gorged with blood, and the intestinal canal reddened. In some instances chrome was detected by tests.*

It would thus appear that the salts of chrome, when swallowed, caused inflammation, but not of a violent kind.

The workmen in Glasgow, who use the bichromate of potash in dyeing, early observed injurious effects from immersing their hands in its solution. Troublesome sores soon broke out on the parts touched by it, and these gradually extended deeper and deeper, without spreading, until they in some cases actually made their way through the arm or hand.†

Dr. Cuming, of Glasgow, and Dr. Baer, of Baltimore, (in which latter place the bichromate of potash is largely manufactured,) confirm the frequency of these effects on the workmen. The former remarks that the first effect of the habitual application to the skin is to cause a papulous eruption, and this after a little time becomes pustulous. If the exposure be continued, deep sloughs form under the pustules. To prevent these effects, an apparatus was constructed so as to require only the immersion of the tips of the fingers; but even here the eruption made its appearance in susceptible individuals.‡ Dr. Baer has seen these ulcers on parts of the body with which he is sure the solution did not come in contact, and he is therefore disposed to ascribe them to the effects of vapors charged with chromic acid. He, however, observed no impression on the skin from the most concentrated form of the solution, when the cuticle was not abraded.

Several fatal cases have occurred in Baltimore of poisoning with the saturated liquor of the bichromate of potash. The following was communicated by Dr. Baer to Professor Ducatel: A laborer, aged thirty-five, on attempting to draw off from a refiner a solution, in the effort to exhaust the siphon by suction received a small quantity of the solution into his mouth. His first impression was that he had spit it out; but only a few

* British and Foreign Medical Review, vol. vii. p. 564.

† Edinburgh Medical and Surgical Journal, vol. xxvi. p. 134.

‡ Ibid., vol. xxviii. p. 301.

minutes elapsed before he was seized with great heat in the throat and stomach, and violent vomiting of blood and mucus. The vomiting continued until just before his death, which occurred in five hours. On dissection, the mucous tissue of the stomach, duodenum, and about one-fifth of the jejunum, was found destroyed in patches. The remaining parts of it could be easily removed by the handle of the scalpel.*

Mr. George Wilson, of Leeds, mentions that an individual, after losing some money, and appearing much dejected, retired to bed at 11 P. M., and was found dead the next morning at 11 o'clock. The external appearance was not indicative of suffering: there were no marks of vomiting or diarrhoea, and the surface was moderately warm. The brain and its membranes, and the thoracic viscera, were healthy. The stomach contained nearly a pint of black, turbid, inky-looking fluid. Its mucous membrane was red and very vascular, but there were no dark stains. The redness did not extend to the œsophagus or duodenum. The dark fluid in the stomach was, on analysis, found to consist of a considerable quantity of bichromate of potash; and in his pockets was found half a pound of the same, united with bitartrate of potash and fine sand, (dye powder.)

The reporter supposes this substance to act powerfully on the *nervous system*, as the death was early, with but slight gastritis; and to be rather sedative than irritant.†

Antidotes. Dr. Ducatel recommends the exhibition of a solution of the carbonate of soda or potash, for the purpose of neutralizing the excess of acid to which the injury is mainly to be ascribed. The subsequent inflammation is to be treated on general principles.‡

The rarer metals have been made the subject of experiments, particularly by Professor Gmelin. A brief notice of their effects will be sufficient.

Molybdenum, in the form of molybdate of ammonia, appears

* Professor Ducatel, in *Baltimore Medical and Surgical Journal*, vol. i. p. 44; Ducatel's *Manual of Toxicology*, p. 144.

† *London Medical Gazette*, vol. xxxiii. p. 734.

‡ Berndt, however, found that in animals poisoned with either of the salts, neither carbonate of potash, sulphate of iron, or tincture of galls proved antidotes.

to be a feeble poison. Half a drachm killed a rabbit in two hours, causing strong convulsions before death. In dogs it produced merely vomiting and diarrhœa, and ten grains injected into the jugular vein did not prove fatal.

Tungsten, in the form of tungstate of ammonia, and in the dose of a drachm, had no effect when swallowed by a dog. The tungstate of soda caused some vomiting. With rabbits, however, the salts of this metal, if given in large quantities, are fatal. They die in convulsions, and some inflammation is found in the stomach.

Tellurium. Of this he had not sufficient to make a complete set of experiments. Ten grains of the oxide killed a rabbit in ten days, without any particular symptoms.

Titanium appears innoxious.

Osmium is an active poison. The muriate causes immediate, violent, and long-continued vomiting, even in small doses. Rabbits were soon destroyed; and the stomach, intestines, and œsophagus were black, rough, and hard on the inside, owing to a reduction of the salt by animal matter. A grain and a half of metallic osmium killed a dog in an hour with vomiting and convulsions.

The hydrochlorate of *iridium* caused vomiting and diarrhœa in dogs, and death in rabbits, apparently through inflammation. Six grains injected into the jugular of a dog produced death in four minutes.

The double muriate of soda and *rhodium* had no effect in doses of fifteen grains on rabbits; and even when ten grains were injected, the immediate prostration was recovered from, and the animal died in five days without any particular symptoms.

The muriate (hydrochlorate) of *palladium* is a very active poison. Three grains injected into the jugular vein of a dog killed it within a minute, by destroying the irritability of the heart, and causing partial coagulation of the blood. A few grains taken into the stomach caused vomiting, diarrhœa, and weariness in dogs. In rabbits it produces no particular symptoms, but loss of appetite and death take place in three days from general and violent inflammation of the stomach.

Nickel. The sulphate is inactive. Twenty grains, given to

a dog, produced no effect except vomiting and weariness. The same quantity, however, caused convulsions and death in a rabbit. When inserted into the cellular tissue, although the whole of the salt was absorbed, no deleterious effect was induced.

Cobalt. This is more active. Thirty grains of the muriate, when swallowed, killed a rabbit within a day. Twenty-four grains inserted under the skin caused frequent vomiting, but the animal recovered. Three grains of sulphate injected into a vein proved fatal in four days.

Uranium. Three grains of the nitrate, when injected into a vein, caused instant death; but dogs swallowed fifteen, and from that to sixty grains, without any effect, except slight vomiting.

Cerium is quite inactive. A drachm caused no inconvenience in a dog, nor half that quantity, on a rabbit.

Manganese presented some peculiar effects. A drachm of the sulphate killed a rabbit in an hour, but thirty grains swallowed by a dog, or two drachms inserted into the cellular tissue, were without any effect. Twelve grains injected into a vein induced death in five days, and the stomach, duodenum, and liver were much inflamed. The latter organ, particularly, was mottled with inflamed streaks, that penetrated into its substance.*

At a subsequent period, Professor Hunefeld, of Griefswalde, found that analogous effects were produced on the liver by manganeseic acid, but that it could hardly be called a poison. Although large doses were given to a rabbit, it survived them; but on being killed, the liver was found soft, and one part bright red, while elsewhere it was of a dark brownish red. When this organ was incinerated, its ashes gave unequivocal indications of manganese.†

Professor Couper, of Glasgow, mentions several cases of disease occurring in that city among men employed in grinding the black oxide of manganese, preparatory to its use in making the bleaching powder. The air is loaded with this

* Gmelin, Edinburgh Med. and Surg. Journal, vol. xxvi. pp. 134 to 138.

† Edinburgh Med. and Surgical Journal, vol. xxxvi. p. 460.

substance in fine dust, and some of it must be swallowed. The earliest symptom observed was a gradual loss of power in the lower limbs. This increased, in several instances, to such a degree that they were obliged to quit their work; and after the lapse of several years the recovery is quite imperfect. The paralysis is not, however, attended with a loss of sensibility, or affection of the intellect. There was no trembling, as results from mercury; or colic, as from lead.

After the knowledge thus acquired of the effects of the black oxide, other individuals were seized with the first symptoms, viz., staggering. They were immediately removed to another employment, and at the end of a few weeks, their health was restored.*

Oxide of *cadmium*, in a dose of twenty grains, made a dog vomit, but ten grains had no effect at all.†

BARYTES AND ITS SALTS.

All its soluble salts are poisonous; the sulphate, being insoluble, is not so. The muriate is generally deemed a more active agent than the pure or the carbonated barytes.

Barytes, whether pure or carbonated, when introduced into the stomach, produces vomiting, hiccough, insensibility, convulsions, and death. The stomach was found inflamed throughout its whole extent, and extravasations of black blood were seen near the pylorus. The lungs and intestines were natural.‡

Mr. Parkes mentions that he visited the mine of carbonate of barytes at Anglezark, in the County of Lancaster, and was informed by Mr. Derbyshire, who occupies the estate on which the mine is situated, that some years since he lost three cows at one time, which had strayed from their pasture, and were found licking some lumps of the spar which at that time lay about the mouth of the mine. It was also stated that it was impossible to keep any fowls upon the farm, as they mistook

* British Annals of Medicine, vol. i. p. 41.

† Christison, p. 453.

‡ Orfila's Toxicology, vol. i. p. 396.

the barytes for white sand. They were sure to die on the first day that they got out upon the land. Mr. Parkes also adds the following quotation from Leigh's History of Lancashire: "Some have been hardy enough to take a drachm at one dose, particularly one James Barnes' wife and child, and in about nine hours afterwards they expired. The like quantity in about three hours will kill a dog."*

A recent case of poisoning by the carbonate has been described by Dr. Wilson: A young female took half a teacupful of it, to which she previously added water. Soon after, she took some medicine, which induced vomiting. In two hours, double vision, pain in the head, and weight in the epigastrium followed. Pain and cramps over the whole body next occurred. Repeated doses of sulphate of magnesia were given, but the pain and cramp continued for several weeks, and her recovery was protracted.†

Muriate of barytes, when injected into the jugular vein, caused great agitation and convulsions, and death ensued in six minutes after the operation. On dissection, the heart was found distended with coagulated blood; the stomach was natural, while the lungs were crepitating, and rather denser than usual.

When applied to a wound in the state of powder, Mr. Brodie found that it produced vertigo, paralysis of the posterior extremities, general insensibility, dilated pupils, convulsions, and death. The stomach and intestines were not affected. The lungs were exactly in the same situation as in the previous experiment.

Orfila and Brodie have each introduced this substance into the stomach of animals. It excited vomiting and purging, violent convulsions, and greatly accelerated the pulse. Insensibility generally ensued previous to death. The mucous membrane of the stomach was of a livid-red color, and it could be easily rubbed off. The muscular coat exhibited two broad patches of a cherry-red color. The lungs were natu-

* Parkes' Chemical Essays, London, 1815, vol. ii. p. 217.

† London Medical Gazette, vol. xiv. p. 488.

ral, but the left ventricle of the heart contained black fluid blood.*

We have also some instances of its effects on the human system. An over-dose (probably seventy or eighty drops) excited violent purging and vomiting, loss of muscular motion in the limbs, and coldness of the extremities, from which the patient did not recover in some days.† An ounce in solution, which was taken by mistake for Glauber's salts, produced instant vomiting, convulsions, pain in the head, and deafness, and death supervened within an hour after the exhibition of the poison.‡

In the case of a female in Germany; related by Dr. Wach, half an ounce of the powder of muriate of barytes was by mistake dissolved in warm water, and swallowed at once. Similar symptoms ensued as in the previous case, with twitchings of the face and limbs, and she died in less than two hours. On dissection, the stomach and intestines were found inflamed, and there was a perforation of the coats of the former, the edges of which were swollen and thickened. The colon was morbidly contracted, and on its inner surface were several broad ecchymosed spots. The pharynx and œsophagus were slightly inflamed. The lungs and brain were congested with thick, black blood.§

Chemical tests. Sulphuretted hydrogen does not produce any change in barytic solutions.

In case the antidote, which we shall presently mention, has been given, additional difficulties will be presented in endeavoring to detect the poison. Probably the most satisfactory process will be to add nitric acid, and then filter and convert the whole to sulphate of barytes, by adding sulphate of soda. Heat the precipitate for half an hour, which will convert the sulphate to a sulphuret. The sulphuretted hydrogen will be

* Chaptal mentions that MM. Huzard and Biron gave to some horses the muriate and carbonate of barytes in doses of 118 grains every day, and these animals died suddenly after having taken them for a few days. (*Chemistry applied to the Arts*, vol. ii. p. 74.)

† *Medical Commentaries*, vol. xix. p. 151.

‡ *Brande's Journal*, vol. iv. p. 382.

§ *Medico-Chirurgical Review*, vol. xxx. p. 205, from *Henke's Journal*.

disengaged by adding muriatic acid, and the earth remains for examination with its tests as given in all works on chemistry.*

Antidotes. From the experiments of Orfila, it appears that the sulphate of soda or magnesia is the proper remedy, when early administered. These decompose the poison, and produce an insoluble sulphate of barytes. Vomiting must always be encouraged.

The salts of *strontia*, according to Gmelin, are very feebly poisonous.†

* Christison, p. 509.

† Edinburgh Medical and Surgical Journal, vol. xxvi. p. 132.

CHAPTER XIX.

IRRITANT POISONS—(*Concluded.*)

4. VEGETABLE AND ANIMAL IRRITANTS. *Vegetable acrids.* Bryonia dioica. Momordica elaterium; elaterine. Cucumis colocynthis. Euphorbia officinarum and other species. Ricinus communis. Jatropha curcas, manihot and other species. Hippomane mancinella. Croton tiglium. Ranunculus acris and other species. Anemone pulsatilla and other species. Caltha palustris. Delphinium staphysagria. Clematis vitalba. Chelidonium majus. Daphne gnidium and mezereum. Convolvulus jalapa and scam-monea. Narcissus pseudo-narcissus. Pedicularis palustris. Gratiola officinalis. Gamboge. Savine. Rhus radicans and other species. Anacardium occidentale. Sedum acre. Rhododendron chrysanthemum. Cyclamen europæum. Plumbago europæa. Lobelia syphilitica and other species. Pastinaca sativa. Hydrocotyle vulgaris. Phytolacca decandra. Calla palustris. Arum maculatum. Sambucus ebulus. Treatment. ANIMAL IRRITANTS. Cantharides—symptoms; cases; appearances on dissection; treatment. Lytta vittata. *Poisonous serpents.* Viper. Rattlesnake—symptoms of its bite; appearances on dissection; treatment. Scorpion. Tarantula. Spider. Bee. Humble-bee. Wasp. Hornet. *Poisonous fishes.* Catalogue of these; cause of fish poison; effects; treatment. Mussels—oysters—crab—lobster—mackerel; dangerous effect of these at certain seasons of the year. Physalia. Toad. Pheasant or partridge—its poisonous nature at certain seasons. Poisonous honey—cause—effects—treatment. Wounds received during dissection—consequences—treatment.
5. MECHANICAL IRRITANTS. *Glass and enamel in powder*—effects—cases. Pins and needles.
6. IRRITANT GASES. Chlorine—effects—antidotes. Nitrous acid vapor—effects—cases. Muriatic acid gas. Sulphurous acid gas. Seleniuretted hydrogen gas.

IN noticing the VEGETABLE ACRIDS OF IRRITANTS, which constitute the fourth class of Irritant Poisons, I shall consider those that belong to the same order of plants in connection with each other. Beyond this, it would hardly be useful to follow a botanical arrangement. The following catalogue will therefore serve as an index:—

<i>Cucurbitaceæ.</i>	<i>Euphorbiaceæ.</i>	<i>Ranunculaceæ.</i>
Bryonia,	Euphorbia,	Ranunculus,
Momordica,	Ricinus,	Anemone,
Cucumis.	Jatropha,	Caltha,
<i>Papaveraceæ.</i>	Hippomane,	Delphinium,
Chelidonium.	Croton.	Clematis.
<i>Thymelææ.</i>	<i>Anacardiaceæ.</i>	<i>Umbelliferæ.</i>
Daphne.	Rhus,	Pastinaca,
<i>Convulvulaceæ.</i>	Anacardium.	Hydrocotyle.
Convolvulus.	<i>Ficoideæ.</i>	<i>Phytolacceæ.</i>
<i>Amaryllidæ.</i>	Sedum.	Phytolacca.
Narcissus.	<i>Ericææ.</i>	<i>Aroideæ.</i>
<i>Scrophularinææ.</i>	Rhododendron.	Calla,
Pedicularis,	<i>Primulaceæ.</i>	Arum.
Gratiola.	Cyclamen.	<i>Caprifoliaceæ.</i>
<i>Guttiferæ.</i>	<i>Plumbaginææ.</i>	Sambucus.
Stalagmites.	Plumbago.	
<i>Coniferæ.</i>	<i>Lobeliaceæ.</i>	
Juniperus.	Lobelia.	

Bryonia dioica, L. (Bryony.) The administration of bryony root has caused vomiting, fainting, violent pain, profuse alvine evacuations, etc. When administered to dogs in whom the œsophagus was tied, death ensued without any previous remarkable symptom; but the mucous membrane of the stomach was of a bright red, and the great intestines were highly inflamed.*

Pyl mentions a fatal case from taking two glasses of an infusion of the root, to cure an ague. Tormina and purging soon followed, and the patient sunk under it.

Brandes and Firnhaber discovered a principle in the root, which is denominated *bryonine*. It acts, according to the experiments of Collard de Martigny, like the plant itself, inducing inflammation and thickening of the coats of the stomach. When twenty grains were injected into the pleura, it caused death in seven hours, and all the marks of true pleurisy were present—serous infusion, pseudo-membrane, and gorging of the lungs.†

Momordica elaterium, L. (Wild or squirting cucumber.) The expressed juice of the fruit of this plant, on standing, deposits

* Orfila's Toxicology, vol. ii. p. 13.

† Edinburgh Medical and Surgical Journal, vol. xxix. p. 215.

a substance which has been variously styled an inspissated juice, a fecula, and an extract, but is, strictly speaking, neither of them. When dried, it forms the medicinal article. Among cathartics, to which class it belongs, it is deemed the most violent, and indeed the severity of its operation is such that it was for a long time almost banished from the practice of medicine. Its active principle is now, however, understood, and its operation can therefore be regulated.

Elaterium, when given to the amount of three drachms, to a dog whose œsophagus had been tied, produced nausea and efforts to vomit, moaning, insensibility, and death. The mucous membrane of the stomach was found highly inflamed, as was also the rectum, but the other intestines were not altered. Similar effects were produced by inserting the extract into a wound.*

A female in Boston took, by the advice of a quack, four pills of the extract of elaterium and rhubarb, (the total being $2\frac{2}{3}$ grains of the extract and 16 of rhubarb.) They produced incessant vomiting and purging; and, notwithstanding the use of remedies, she sunk in thirty-six hours after the last pill was taken. On dissection, the mucous membrane of the stomach was found to be highly injected, the colon contracted, and all the intestines inflamed. The other viscera were healthy.†

Drs. Clutterbuck and Paris were supposed to have discovered the active principle of this substance some years since; it was styled *elatine*. This, however, was a compound; and Dr. Morries, of Edinburgh, and Mr. Hennel, of London, nearly at the same time, obtained the peculiar crystalline principle, which deserves that name. A tenth of a grain will purge a man; and a fifth of a grain, in two doses, killed a rabbit after some hours.‡ It is now named *elaterine*.

* Orfila's Toxicology, vol. ii. p. 14. Dr. Parsons did not find the inflammation of the rectum, in an experiment performed by him on a dog. (American Medical Recorder, vol. xiv. p. 356.)

† Boston Medical Magazine, vol. iii. p. 25.

‡ London Medical Repository, vol. xii. p. 5; Paris' Pharmacologia, p. 270; Edinburgh Medical and Surgical Journal, vol. xxxv. p. 339; Journal of the Royal Institution, vol. i. p. 532.

Cucumis colocynthis, L. (Bitter apple.) The only part of this plant which is used in medicine is the dried, spongy, or medullary part of the fruit. It is well known as a drastic cathartic. Stalpart relates a case where an individual took some of it, and was shortly after seized with the most excruciating pains in the abdomen, bloody evacuations, and violent spasms.* He also quotes cases from Tulpus, Schenkus, and Platerus, indicating its powerful operation; and mentions that, in one instance, death followed from an enema, in which not more than a drachm of colocynth had been infused.

An individual laboring under hemorrhoids; and affected with indigestion, took two glasses of a decoction, which subsequently proved to be that of colocynth. Frequent alvine evacuations, accompanied with colic, were among the first effects; and some hours afterwards he complained of great heat in the bowels, dryness in the fauces, and unquenchable thirst. The pulse was small and extremely rapid; the tongue red; the abdomen intolerant of pressure; and there was a very violent fixed pain in the vicinity of the umbilicus. The evacuations by the bowels had now ceased. The antiphlogistic regimen was employed, but without success. Coldness of the extremities succeeded, and he gradually sunk, after a previous diminution of the abdominal pain. On dissection, the abdominal viscera exhibited marks of the most violent inflammation. The peritoneal cavity was filled with a whitish fluid, containing flocculi of the same color. The intestines were reddened, and thickly studded with black specks; most of them were either adherent or covered with adventitious membrane. The mucous membrane of the stomach was detached and ulcerated, and the peritoneum in an almost putrid condition. Traces of inflammation existed also in the liver, kidneys, and bladder.†

A coroner's inquest was held in London in 1823, on the body of a woman, who died after twenty-four hours of incessant

* "Fateor," he observes, "profecto nunquam me tam horrenda in quodam conspexisse symptomata." (Stalpart, vol. i. p. 173.)

† Orfila's Toxicology, vol. i. p. 796, third edition. Case communicated by M. Carron d'Anneey.

vomiting and purging, in consequence of having swallowed by mistake a teaspoonful and a half of colocynth powder.*

The symptoms produced on animals, by the introduction of this substance into the stomach, are in general similar to those experienced in the human subject. Dissection exhibits an inflammation of the *stomach* and *rectum*, while the great bulk of the intestines are in a natural state. No eschar was noticed.†

The active principle of this plant was discovered by Vauquelin, and is termed *colocynthin*.

Euphorbia officinarum, L. The stalk of the various species of the genus *Euphorbia* furnishes a milky juice, which, on being dried, is called *euphorbium*. It is a resin, and obtained principally from the above plant.‡ Its medicinal use is solely as an errhine, and farriers employ it for blistering horses.

A female in Lincoln, England, took by mistake, eighteen days after delivery, two ounces of a tincture prepared with camphor, alcohol, and euphorbium. She immediately experienced a violent suffocation, burning, and pain in the throat and stomach. On the administration of warm water, copious vomiting was induced, but the pain continued for some time, nor was it relieved until after the repeated application of suitable remedies.§

In another instance, a teaspoonful was administered by a farrier, in the dark, through mistake for rhubarb. A burning heat in the throat and fauces was immediately felt, which soon extended to the stomach; an incessant vomiting of watery fluid took place; the tongue was covered with thick mucus; the pulse was very irregular, and at least 150 in a minute; and the patient was in a cold perspiration, and unable to speak intelligibly. An emetic was given, but it brought away only

* Christison, p. 524.

† Orfila's Toxicology, vol. ii. pp. 17, 21.

‡ This species is a native of the Cape of Good Hope, and the recent juice is so corrosive as to erode the skin wherever it touches. The people who gather it, tie a cloth over the mouth and nostrils, to protect them from the acrid dust of the withered branches. (Thomson's London Dispensatory, p. 297.)

§ Case by Dr. Willis, Philosophical Transactions, vol. li. p. 662.

a small quantity of a thin, black fluid; mucilages and anodynes, when exhibited, were almost instantly rejected. The patient lived nearly three days; on opening the body, eight hours after death, there were found in the stomach several gangrenous spots, and its coats tore on the slightest touch. The spleen was much enlarged and rotten, while the vessels of the internal coat of the aorta were beautifully injected with blood, and showed marks of the highest degree of inflammation.*

When introduced into the stomach of animals, it produced violent pain and death; and the stomach, on dissection, contained a red, bloody fluid, mixed with powder of euphorbium; its coats were all of a very deep red, and the colon and rectum were highly inflamed.†

Several chemists have examined this substance, and found in it a resin, in which its active principles reside. This again has been ascertained to be a compound, and the leading ingredient extracted from it is styled *euphorbin*.‡

Many other species of euphorbia are poisonous, as the *E. lathyris*, L.; the *E. cyparissias*, L.; and the *E. tirucalli*, L.

In the case of a child poisoned by the seeds of the first named, vomiting was followed by drowsiness, deep sleep, and stertorous breathing. Some of these indicate a narcotic operation.§ The second of these excoriated a man's face on being rubbed with it; and Lamotte mentions that a clyster prepared with this plant proved fatal. In a person who allowed his closed eyelids to be rubbed with the juice of the *E. esula*, L., inflammation followed, and it was succeeded by the loss of the eye.|| Hyder Ali, in his ferocious wars against the English

* Brande's Journal, vol. iii. p. 51. Case communicated by Mr. Furnival.

† Orfila's Toxicology, vol. ii. p. 43.

‡ Christison, p. 518. Chevallier and Aubergier have found the seeds, and the oil expressed from them, of the *Euphorbia hyberna*, very energetic. The seeds yield forty-four per cent. of oil; and in doses of ten drops, it causes copious watery evacuations without pain. (Ibid., third edition, p. 541.)

§ Christison, third edition, p. 541. Case by Dr. Hood. See also a case by Dr. Jacob, in the Chemist, vol. v. pp. 326, 367, from the Journal de Chimie Médicale. There were no striking appearances on dissection, although the person survived three days.

|| Scopoli, quoted by Orfila.

in India, ordered the wells to be poisoned with the *E. tirucalli*, L.* The juice of the *E. antiquorum*, L., and *E. heptagona*, L., are each said to be employed by the inhabitants of the countries where they are native, in poisoning their spears and arrows.†

A case of poisoning with the *E. peplus*, L., (Petty spurge,) occurred in England. A boy, six years old, ate it by mistake. It induced vomiting and purging, spasms, small pulse, inability to swallow, insensibility, cold extremities, and death. On dissection, the tonsils, fauces, and pharynx were seen much inflamed; the mucous membrane of the stomach and small intestines was red, but the large intestines were healthy, except that their muscular coat was slightly vascular; the bladder was greatly contracted; the epiglottis and larynx highly inflamed, and containing some tenacious green mucus; the lungs were healthy; the blood fluid, or only partially coagulated; the veins of the dura mater distended, but the substance of the brain healthy.‡

Dr. Harlan mentions the case of two children, in whom the seeds of a certain plant induced vomiting and purging, followed by stupor and dilated pupil. An emetic, succeeded by a purgative, relieved the symptoms. On showing a specimen of the plant and its seeds to the late Abbé Correa de Serra, he pronounced it to be *Euphorbia latus*.§

The *E. corollata*, L., of this country, appears, according to Dr. Zollickofer, to possess epispastic properties.||

Ricinus communis, L. (Palma Christi, castor-oil plant.) The castor-oil used in medicine is obtained by expression from the seeds of this plant. They act in the most powerful manner on the system, and produce violent vomiting and purging; such was also the effect observed by Orfila on animals. Thirty

* Quarterly Review, vol. xviii. p. 47, American edition.

† Ainslie's Materia Indica, vol. i. p. 123. History of British India, (Family Library,) vol. iii. p. 122.

‡ Medico-Chirurgical Review, vol. vii. p. 275.

§ Harlan's Researches, p. 603.

|| American Journal of Medical Science, vol. xii. p. 76. Hannibal, when pursued by the Romans, took some poison which he had carried about him in a ring, and died immediately. It is a conjecture of the eminent Mr. Hatchett that this may have been the inspissated exudation of the *Euphorbia officinalis*. (Sir Henry Hallford's Essays, p. 156.)

grains produced death in a small dog whose œsophagus was not tied. Inflammation and ulceration were noticed in the stomach.*

A female at Liverpool, aged eighteen, ate about twenty of the seeds. She died after four days' illness, and on dissection the stomach and intestines were found highly inflamed.†

Jatropha curcas, L. (India-nut. Tuva-tree of the Philippine Islands.) The seeds of this plant act as a violent poison, and excite vomiting, insensibility, great weakness, and death. Violent inflammation was found in the mucous membrane of the stomach and intestines. It was more active in its operation when introduced into the stomach than when applied to the cellular texture.‡ § An oil is obtained from the seeds, and it is even an article of commerce under the name of English croton oil.

Dr. Letheby relates a very severe case induced by eating some of the seeds. The symptoms were those of high irritation, but the patient recovered by means of an opiate and a mild cordial. He refers the poisonous principle to the solid and non-oleaginous parts of the seed, and doubts whether the oil can be very powerful in its action.§

The fresh root or the juice of the *Jatropha manihot*, L., (*Janipha manihet*, Kunth,) has been long known as a violent poison.|| It produces swelling of the body, nausea, vomiting, and purging, pain, tenesmus, loss of sight, coldness of the extremities, faintings, and death.¶ Dr. Clark, of Dominica,

* Orfila's Toxicology, vol. ii. p. 29.

† London Medical Gazette, vol. xix. p. 944.

‡ Mr. Bennet says that the seeds are used as a purgative by native doctors of the Philippine Islands. In an overdose, they produce vomiting and purging and violent pain. The only antidote of the native practitioners is repeated draughts of cold water. (London Medical Gazette, vol. ix. p. 8.)

§ London Medical Gazette, vol. xlii. p. 116.

|| See Piso, quoted by Orfila, vol. ii. p. 73; and Philosophical Transactions, vol. ii. p. 634.

¶ Humboldt states that there are two kinds of *juca* which furnish the cassava or manihot. The root of the *juca dulce* is perfectly innocent, but that of the *juca amarga*, or bitter manihot, conceals a deadly poison. Heat, however, will destroy its noxious qualities. (Edinburgh Review, vol. xvi. p. 245; American edition.)

knew a strong negro to die in little more than an hour after drinking half a pint of the juice. Thirty-six drops were administered to a criminal. They had scarcely reached his stomach when he writhed, became convulsed, and died in six minutes. On dissection, no alteration was found, except that the stomach was shrunk to half its natural size.*

The *Jatropha multifida*, L., is probably equally poisonous.†

Hippomane mancinella, L. (Manchineel-tree.) Dr. Peysonnel relates that a soldier, who was a slave with the Turks, ate some of the apples of this tree, and was soon seized with a swelling and pain in the abdomen. His lips were ulcerated with the fruit, and a cold sweat came over him. Having taken some remedy, (the avellana purgatrix,) vomiting and purging were induced to a violent degree. He, however, gradually recovered.‡

The wood of this tree, when green, will excite inflammation on the skin when rubbed against it;§ it affords a most beautiful article of furniture, being interspersed with green and yellow veins, like marble; but the dust is of so acrid and poisonous a nature that the sawyers and carpenters are forced to work with gauze masks, to protect them from its injurious effects.||

Dr. Ricord Madianna, in his experiments on animals, found that the juice excited inflammation, even when applied to the sound skin.¶

Orfila and Ollivier applied it to a wound in the cellular

* Medical Facts and Observations, vol. vii. p. 289; Edinburgh Journal of Geographical and Natural Science, vol. iii. p. 384, from Hooker's Botanical Magazine.

Philadelphia Journal of Pharmacy, vol. vii. p. 279. From an analysis of O. Henry, it appears that the juice of the *jatropha manihot* contains hydrocyanic acid. He also obtained it from the fresh roots. Journal de Pharmacie, vol. xxii. p. 118.

† Brande's Journal, vol. xx. p. 95.

‡ Philosophical Transactions, vol. i. p. 772.

§ Ibid., vol. iii. p. 824.

|| Edinburgh Review, vol. xvii. p. 374, American edition.

¶ New York Medical and Physical Journal, vol. iii. pp. 309, 439. Dr. Ricord thinks that the *feuillea cordifolia* alone deserves the name of an antidote to this poison.

tissue with fatal consequences, and when given internally it destroyed the animal. On dissection, the stomach and intestines were found highly injected.*

"Other species of hippomane are equally poisonous. The *H. biglandulosa* and *H. spinosa* are peculiarly so, especially the latter, which is known to the negroes of St. Domingo by the name of Zombi apple, and is familiarly used by them as a potent poison."†

Croton tiglium, L. (Purging croton.) The seeds of this plant have an acrid, nauseous, and burning taste. They were formerly employed as hydragogue purgatives; but on account of the violence of their operation were completely laid aside. One seed is a dose, and even this sometimes excites violent purging and vomiting.‡

Within a few years past the expressed oil of this plant has come into use as a purgative. From one to three drops is a dose, and we of course meet with cases in which larger quantities have been taken through mistake.

Dr. Keith enumerates three of these. In the first, a teaspoonful of the oil was given to a child four years old, instead of a cough mixture, (the actual quantity taken was about half a drachm.) It induced violent vomiting and purging in less than eight minutes, with pain and thirst, followed by great prostration. He was saved by the use of emollients and other appropriate remedies. In a second case, (quoted from the *Gazette des Hôpitaux*,) vomiting did not come on until after three hours, when it was excited by powerful means; there

* Orfila's *Toxicology*, third edition, vol. i. p. 719.

† Christison, third edition, p. 544.

Manchineel-tree. "The common stories about the fatal shade of this tree are as fabulous as the changing colors of the dying dolphin. The *shade* is as harmless as any other shade. The fact is, the juice of the manchineel is highly corrosive and easily extracted, so that rain water or heavy dew will contract upon the leaves or branches so much of the poison as would certainly blister any flesh it fell upon. The manchineel is very fine timber, and the negroes usually smear themselves over with grease when they are about to fell it. It is also a common trick with them to blister their backs with the juice, in order to excite the compassion of those who mistake it for the effects of beating." (Henry N. Coleridge's *Six Months in the West Indies*, p. 261.)

‡ *Edinburgh Medical and Surgical Journal*, vol. xiii. p. 256.

was obstinate constipation. The patient did not perfectly recover for a month. The third case is related in the *Journal de Chimie Médicale*: death ensued to a young man, laboring under typhus, from swallowing two and a half drachms of the oil. Vomiting could scarcely be induced, but severe purging ensued, which finally became involuntary, and he sunk in four hours.

Dr. Keith refers to a case mentioned by Pereira, in which symptoms of burning pain in the throat, stomach, etc., followed from inhaling the dust arising from unpacking and emptying packages of croton seeds.*

Ranunculus acris, L. (Butter-cups.) The leaves are an acrid and irritating external application, producing inflammation and ulcers. Internally given, the juice of the leaves caused inflammation of the mucous membrane of the stomach.

Ranunculus sceleratus, L., (water crowfoot,) excited severe pains and convulsive movements in Krapf, although he took only a single flower, which he had well pounded. Its leaves and juice excoriated the tongue and mouth, and excited burning pain in the œsophagus. Plenck destroyed a dog with its juice, and found the stomach red and corroded, and the pylorus tumefied. Externally applied, it occasions extensive ulcers.

Ranunculus flammula, L., has often destroyed whole flocks of animals grazing on it in the spring,

Ranunculus arvensis, L., poisons sheep; three ounces of its expressed juice killed a dog in four minutes.†

Several other species are equally poisonous, as the *bulbosus ficaria*, *alpestris*, *aquatilis*, etc.‡ The root of the *R. thora* is extremely so. "Its juice was formerly used by Swiss hunters

* London and Edinburgh Monthly Journal of Medical Science, vol. iii. p. 1030. According to Dr. Nimmo, of Glasgow, the kernels of the seeds of the croton are composed of 27 parts of acrid purgative principle, 33 of fixed oil, and 40 of farinaceous matter in the hundred. The oil itself consists of 45 acrid principle (*crotonin* or *tiglin*.) and 55 fixed oil. (Brande's Journal, vol. xiii. p. 62.)

† London Medical and Physical Journal, vol. xxi. p. 12.

‡ The *ranunculus acris*, *sceleratus*, *flammula*, *bulbosus*, and *aquatilis* are natives of the United States. According to Dr. Pulteney, (Transactions Linnean Society,) several species are eaten by animals without injury. See his observations in the Philosophical Magazine, vol. vi. p. 210.

to envenom their weapons, and wounds so produced are said to have become speedily fatal." (*Lindley's Flora Medica*.)

Anemone pulsatilla, L. (Wind-flower.) Bulliard relates the case of an old man with rheumatic gout, who applied the root of this plant, bruised, to the calf of his leg, on going to bed. Cruel suffering succeeded for ten or twelve hours, and the whole limb became gangrenous, nor was it restored until after the application of vigorous remedies. The dried root, on being pounded, has excited irritation of the eyes, itching, and vomiting. Lastly, animals to whom the extract or the juice of the leaves had been administered, sank under it, and exhibited the marks of violent inflammation in the stomach and rectum. The dried powder gave no inconvenience to them.*

The *Anemone pratensis*, *sylvestris*, and *nemorosa*, are also deemed poisonous. The latter produces dysentery in sheep feeding on it.† The inhabitants of Kamtchatka make use of this plant to poison their arrows, and the wounds are most commonly fatal.‡

Caltha palustris, L. (Marsh marigold,) is said by Christison to be extremely acrid. A family of five persons in Germany took some of it for food. They were all seized in half an hour with sickness, pain in the stomach, vomiting, dysuria, and diarrhoea, and on the next day with swelling of the whole body, and a copious eruption. They, however, all recovered.§

Delphinium staphysagria, L. (Palmated larkspur, staves-acre.) An ounce of this substance introduced into the stomach of a dog, whose œsophagus was tied, caused dejection, but neither vertigo nor convulsions, and death succeeded in fifty hours. The mucous membrane of the stomach was inflamed,

* Orfila's Toxicology, vol. ii. pp. 43, 44.

† London Medical and Physical Journal, vol. xxi. p. 12.

‡ Orfila's Toxicology, vol. ii. p. 46. Mr. Robert extracted a fluid, of an acrid taste and pungent odor, from the flowers of the *Anemone pratensis*, L., which acted like a caustic on the tongue. Vauquelin examined and confirmed his experiments, and deems the substance a peculiar one, which is probably common to the Clemates and Ranunculi. It should be arranged according to him, with the concrete oily substances. (London Medical Repository, vol. xiv. p. 403.)

§ Christison, p. 257, from Rust's Magazine.

but the other organs presented no alteration. When applied to a wound in a moistened state, it induced dejection, vertigo, and finally death. The wound was inflamed, and the limb greatly swelled, but the digestive canal was sound. Its local effects are evidently the most striking.

Lassaigue and Fenuelle discovered the alkaloid, *delphine* in this plant. It is described as extremely acrid.*

Delphinium tricornes, Mx., is one of the plants, according to Professor Short, indefinitely called *stagger-weed*, and to the eating of which the diseases of cattle are sometimes attributed in the Western States.†

Clematis vitalba, L. (Virgin's bower.) *Clematis flammula*, L., *erecta*, L., and *integrifolia*, L. These are all acrid and caustic. When applied to the skin they produce redness, pustules, and excoriations; introduced into the stomach, they caused an inflammation which destroys the animal.‡

Chelidonium majus, L., (Celandine,) induced death in animals, both when introduced into the stomach and when applied to wounds, by Orfila. In the former case the stomach was found inflamed, but not in the latter. The wounds, however, were inflamed and livid; and from both modes of application the lungs were seen livid and distended with blood. This plant is naturalized in this country. The *Chelidonium glaucum* has caused delirium and purging in a family who ate of a pie in which it had by mistake been put.§

Daphne gnidium, L. (Spurge flax. Flax-leaved daphne.) The bark of this substance, like the poisons already noticed,

* Annals of Philosophy, vol. xvi. p. 32; Edinburgh Medical and Surgical Journal, vol. xlii. p. 234.

† Florula Lexingtoniensis, in Transylvania Journal, vol. i. p. 411. Mr. Hopkins has shown the presence of delphine in the *D. consolida*. (American Journal of Pharmacy, vol. xi. p. 1.)

‡ Dr. Lindley (Flora Medica) adds to these, *C. dioica* and *mauritiana*, as equally caustic when applied to the skin. Alkaloids have also been discovered in this species.

§ Philosophical Transactions, vol. xx. p. 263. M. Potex is said to have discovered two alkalies in the root of *Chelidonium majus*, to which he has given the names of *Chelidonia* and *Pirropina*. (London and Edinburgh Philos. Magaz., vol. xvii. p. 543.) In another place, (ibid., vol. xviii. p. 32,) Dr. Probst, of Heidelberg, is said to be the discoverer of *chelidonia*.

excited vomiting, local inflammation, and death, and the stomach presented an appearance similar to what has been already described.

Daphne mezereum, L., (Mezereon,) acts in a similar manner. Linnæus relates that a young lady died from hæmoptysis, occasioned by taking twelve berries of this plant.* Several other species are deemed poisonous. In animals poisoned by the *Daphne laureola*, L., (Spurge laurel,) Orfila observed a sanguineous effusion below the mucous coat of the stomach.†

Three children, the oldest three years of age, swallowed some of the berries of the *D. mezereum*. It induced, in all, violent purging and vomiting. Two recovered; but in the third, alarming symptoms of prostration and narcotism followed, which required the active employment of stimulants to overcome. Subsequent to this, cathartic medicines were found necessary.‡

Convolvulus jalapa, L. (Jalap.) *Ipomæa jalapa* (Nuttal.) In large doses this is an acrid poison. Mr. Hume, and Drs. Buchner and Herberger, appear to have established that its active properties reside in a resinous principle, termed *jalapine*.§

Convolvulus scammonia, L. (Scammony.) The experiments of Orfila contradict the opinion of some toxicologists, that the juice of this plant is poisonous. He frequently administered four drachms of it to dogs, and had the œsophagus afterwards tied, and he only observed alvine evacuations.' They lived six or seven days.

Narcissus pseudo-narcissus, L. (Meadow narcissus, daffodil.) The extract of this plant, whether externally or internally used, produced violent vomiting or attempts to vomit. Death shortly ensued, and in every instance the mucous membrane of the stomach was inflamed, and, in several, that of the rectum.

* Orfila's Toxicology, vol. ii. p. 27.

† Andral, quoted in Journal of Foreign Science, vol. iii. p. 402. Vauquelin and Dublanc have analyzed the plants of this species. (Brande's Journal, vol. xviii. pp. 177, 401; Christison, p. 528.)

‡ Dr. Grieve, of Dumfries, Lancet, vol. xxi. p. 43. See also Medical Times, vol. x. p. 427.

§ Christison, p. 529.

The emetic qualities of this plant, according to M. Jourdain, reside in a peculiar principle called *narcitine*.*

Pedicularis palustris, L., has an acrid, burning taste, and is said by Gleditsch and Gunner to have injured sheep and oxen.

Gratiola officinalis, L. (Hedge hyssop.) Death followed after a considerable interval, from the introduction of the extract of this substance into the stomach of animals; the mucous membrane was inflamed. The same result followed from inserting it into a wound, but the stomach was sound.†

Stalagmites cambogioides, Murr. *Garcinea cambogia*, D. C. (Gamboge.)‡ This gum-resin, when introduced in quantity into the stomach of any animal, whose œsophagus was tied, produced violent efforts to vomit, purging, dejection, and death. The mucous membrane of the stomach was inflamed, and some reddish spots were seen in the rectum. When this operation was not performed, and dogs were suffered to vomit, it did not cause any serious accident.

Gamboge probably forms the active ingredients in *Morrison's Pills*, which have been so profusely taken of late years. Several fatal cases have occurred from their use, and, on examination, inflammation of the stomach or intestines was observed.§

Mr. Pereira recommends the following as a mode of detection of the presence of gamboge: Digest one portion of the suspected substance in alcohol, and the other in ether. In

* American Journal of Pharmacy, vol. xiii. p. 109.

† Dr. Whiting announced, at a meeting of the London Medico-Botanical Society, that *veratrine* has been discovered on this plant. (Burnett's Medical Botany, vol. i.)

‡ [Dr. Graham has ascertained not only that the *Stalagmites cambogioides* does not produce the gamboge of commerce, but that there actually is no such plant, Murray's description being taken from a specimen made up of parts of two different plants.

The gamboge of commerce comes from an unknown tree in Siam; but the *Hebradendron gambogioides* of Ceylon certainly does produce a gamboge similar to that of Siam, as does also the *Garcinia pictoria* of Mysore. (Edinburgh New Philosophical Journal, vol. xxi. p. 159; vol. xxiv. pp. 106, 229. Hooker's Companion to the Botanical Magazine, vol. ii. p. 233.)—C. R. G.]

§ Fatal cases are recorded in London Med. Gazette, vol. xvii. pp. 357, 416, 623; vol. xviii. p. 74. Case of Capt. McKenzie. Mr. R. Philips analyzed some of the pills and found cream of tartar, aloes, and gamboge.

either case there will be an orange-red tincture. The ethereal dropped on water yields, on the evaporation of the ether, a thin, bright yellow opake film or scum, (*gambogic acid*;) soluble in caustic potash. The alcoholic, dropped into water, yields a bright, opake yellow emulsion, which becomes clear, deep red, and transparent, on the addition of caustic potash. This gambogiate of potash, obtained by either process, gives, if the alkali be not in excess, with acids, a yellow precipitate, (*gambogic acid*;) with several metallic salts, as acetate of lead, nitrate of silver, yellow precipitates; with sulphate of copper, brown, (*gambogiate of copper*;) and with salts of iron, dark brown, (*gambogiate of iron*.)*

Juniperis sabina, L. (Savine.) A native of the south of Europe, and America. Found in the Rocky Mountains by Lewis and Clarke.

This is well known as a powerful stimulant. When administered to animals in doses of four and six drachms, it caused death and left inflammation of the mucous membrane of the stomach, with a small ulcer near the pylorus. The rectum was somewhat inflamed. And this last was observed in every experiment.

The abuse of the substance, both in the form of oil and powder, in producing abortion has been noticed in another place, and the case communicated by Mr. Cockson, of Macclesfield, to Dr. Christison, referred to.† I may add the remaining particulars. The female miscarried in about fifty-four hours, (on Saturday,) and she died on Thursday following.

Mr. Cockson on dissection, found extensive peritoneal inflammation, and the inside of the stomach of a red tint, checkered with patches of florid extravasation.‡

Rhus radicans, L., *toxicodendron*, L., *vernix*, L., *R. venenata*, D. C. All these are natives of the United States, and the *R. radicans* and *toxicodendron* are by some deemed merely varieties of the same species.

* Pereira's Elements of Materia Medica, part 2, p. 1230.

† Vol. i. p. 483.

‡ Christison, p. 532. Dr. Lee states that a female lately died in New York, from taking one drachm of the oil of savine, to procure abortion. (American Journal Med. Sciences, vol. xxi. p. 358.)

The watery extract of the *radicans*, when internally administered or applied to the cellular texture, produced a local irritation and inflammation, and after death the mucous coat of the stomach was seen inflamed.

The juice of the *Rhus toxicodendron* (Poison oak, poison ivy.) is said by Fontana to have proved innocent to animals who were made to swallow it; but a very small portion of the milky juice applied to the human skin, excited swelling not only in the part touched, but also over the face, eyelids, and ears. This was the case with our author himself. A severe burning and itching continued for several days, and small vesicles, filled with a transparent sharp humor, formed in various places over his hands. Nearly the same symptoms occurred from touching the leaves.* I may add, that similar effects are very common in this country from touching this plant. Dr. Alderson even states that sphacelation has followed, of such parts of the skin as the acrid juice had touched, in some cases in England.†

The *Rhus vernix, venenata*, D. C., (Poison sumach,) produces similar effects. Blindness has been caused by merely handling it.‡ And Dr. Bigelow mentions that he has known individuals badly poisoned in winter, from the wood of the *rhus vernix* accidentally burnt on the fire.§

* Medical Commentaries, vol. xii. p. 110. "The juice of the *Rhus toxicodendron* produced enormous swellings on some laborers in the Jardin des Plantes, wherever it touched them." (Sage, Edinburgh Medical and Surgical Journal, vol. ix. p. 378.)

† Medical Commentaries, vol. xx. p. 10. Mr. Van Mons has advanced an opinion that the hurtful effects of this plant depend on a gas which it exhales during the night or in the shade, rather than on its milky juice. He seems to have proved the irritating effects of this gas. (Orfila, vol. ii. p. 42.) We have, however, too great a mass of testimony proving the nature of the juice, to allow us to consider it innoxious. Dr. B. S. Barton's account of its effects on himself is alone sufficient. It excited itching, and swelling, and vesicles, which desquamated. (New York Medical Repository, vol. viii. p. 200.)

‡ See an account of the poisonwood-tree in New England, by the Hon. Paul Dudley, F.R.S. (Philosophical Transactions, vol. xxxi. p. 145; and Dr. Cutler, in Memoirs of the American Academy of Arts and Sciences, vol. i. p. 429.)

§ Bigelow's Medical Botany, vol. i. p. 109. Cases are related by Dr. Bigelow, pp. 103 to 107, of the poisonous effects and exhalations and juice of this

Several other species of the rhus are poisonous, particularly the *R. pumilla*, Mx., of Carolina, and the *R. veneficera*, D. C., *perniciosa*, Kunth.*

The *Anacardium occidentale* (Cashew-nut) is an allied plant to the above, and Lindley (Medical Botany) states that the coats of the nut contain an abundance of a caustic oil, which blisters when applied to the skin. Dr. Stickney, of Philadelphia, relates a case, (Medical Examiner, vol. vii. p. 133,) in which the juice rubbed on the back of the hand caused a severe and painful eruption over various parts of the body, with swelling, while the parts touched blistered and desquamated.

Sedum acre, L., (Houseleek. Wall pepper.) This produced death when given internally, and the mucous membrane of the stomach was seen of a fiery-red color.

Rhododendron crysanthum, Pall. The decoction of this plant has an acrid, burning taste; it is emetic, drastic, and inflames the texture to which it is applied. The *Rhododendron ferrugini-*

plant. See also Dr. Horsfield's Inaugural Dissertation on the *Rhus vernix*, *radicans*, and *glabrum*, 1798, in Caldwell's Medical Theses, vol. i. p. 128.

On the treatment of the disease excited by these plants, and which is almost identical with the *diffuse inflammation* of Dr. Duncan, Jr., see Dr. Fountain, in New York Medical and Physical Journal, vol. v. p. 409; Dr. Christy, in do., vol. viii. p. 21; Dr. Dakin, in American Journal of Medical Sciences, vol. iv. p. 98; Boston Medical Magazine, vol. i. p. 282; vol. ii. p. 75; Boston Medical and Surgical Journal, vol. xvii. p. 347; *ibid.*, vol. xviii. p. 303.

The chloride of soda has proved very useful as a wash in several instances.

* The Indian varnishes appear to produce similar effects on the skin. One of them is made from the *Melanorrhæa usitata* of Wallich, the varnish-tree of Munipur, and allied plant to the rhus. Sir David Brewster received from Mr. Swinton several specimens, and it was found that the slightest touch to the skin induced swelling and great pain. One of the servants was nearly killed by the sylhet varnish. (Edinburgh Journal of Science, vol. viii. p. 101; *ibid.*, N. S., vol. ii. p. 71.)

The *Stagmaria verniciflua* of Jack, a native of Sumatra and the neighboring islands, possesses similar properties. According to Rumphius, it is the tree which yields the celebrated Japan lacquer or varnish. The resin from the bark causes excoriation and blisters. (Hooker's Companion to the Botanical Magazine, vol. i. p. 268.)

The fine varnish used in China is made from a species of rhus, and in a liquid state is injurious to the manufacturers, unless they be protected with masks. (The Chinese, by J. F. Davis, vol. ii. p. 341.)

neum, L., is said to be deadly poisonous. Welsch speaks of a meal which became fatal to the guests, from having eaten of a hare which had been fed upon its leaves.

The *R. maximum*, L., (Pennsylvania mountain laurel, American rose bay,) is, according to Dr. B. S. Barton, undoubtedly a poison.*

Cyclamen europæum, L. A violent cathartic, and it also excites vomiting. Bulliard states that its root produces cold sweats, dizziness, and convulsive movements; the patient voids blood by vomiting and by stool; and a super-purgation supervenes, which proves fatal.

Plumbago europæa, L. Sauvages observes that the workmen who make use of the decoction of this plant for the purpose of obtaining a yellow dye, are tormented by a severe headache if they work longer than six hours. Its taste is acrid and almost caustic. Dulong has discovered a peculiar principle in the root, which is called *plumbagine*.†

Lobelia syphilitica, L., (Cardinal flower.) A native of the United States. This is an acrid plant, and acts as an emetic and purgative.

The *Lobelia longiflora*, L., possesses still more energetic properties. In Spain, according to Orfila, it is called *Rabienta cavallos*, because it kills horses.

Lobelia inflata, L., (Indian tobacco. Emetic weed. Eyebright.) A native of the United States. This is a powerful emetic, and distressing and long-continued sickness often accompanies its operation. "A melancholy instance of death, occasioned by the use of this plant, in the hands of a quack, is detailed in the sixth volume of the Massachusetts Reports, in the trial of Samuel Thompson, an empiric practicing in Beverly, for the murder of Ezra Lovett. In this trial, it appeared that the patient, being confined by a cold, sent for the pretended physician, who gave him three powders of lobelia in the course of half an hour, each of which vomited him violently, and left him in great perspiration during the night. The next day two more powders were administered, each of

* Barton's *Materia Medica*, part 1, p. 18.

† Brande's *Journal*, vol. vi. p. 192.

which operated by vomiting, and occasioned great distress. In like manner two other powders were given the subsequent day, leaving the patient in a state of great prostration. Several days after this, the physician came again, and finding his patient still worse, administered several more powders, which occasioned great distress, and at length ceased to operate. Finding that the stomach was not sensible to the emetic effect of the lobelia, the physician repeated the dose, and when the patient complained of great distress at the breast, and said he was dying, the doctor assured him the medicine would soon get down, or operate as a cathartic. However, on the same evening, the patient lost his reason and became convulsed, so that two men were required to hold him. To relieve this, the doctor forced down two more of his powders, and the patient, as was to be expected, grew worse, until he expired.

"The doctor, who had thus terminated the disease and the patient at once, was arrested and put upon trial for murder; but the homicide proving a legitimate one, from the want of a sufficient evidence of malice prepense, he was acquitted and set at liberty."*

Horses and cattle have also been killed from eating this plant.

I do not exaggerate, when I state that thousands of individuals in the United States have been murdered by the combined use of capsicum and lobelia, administered by the Thompsonian quacks.

The delusion seems to have spread to England. In August, 1849, an individual was tried for administering a large quantity of this substance to a person, of which he died. It appeared on the trial, that a certain Dr. Coffin had published and lectured in favor of the article, and that the person indicted belonged as usual to a "Botanical Society."

It will not surprise my medical readers to learn that the prisoner was acquitted.†

* Bigelow's Medical Botany, vol. i. p. 181; Tyng's Massachusetts Reports, vol. vi. p. 134, *Commonwealth v. Thompson*.

† London Med. Gazette, vol. xlv. pp. 383, 433, 472. For cases of conviction of having caused death by lobelia, see Wharton and Stillé, Medical Jurisprudence, p. 522; Taylor on Poisons, p. 732.

Professor Colhoun, of Philadelphia, has made some experiments on the active principle of this plant, and Mr. Procter, in his inaugural essay before the Philadelphia College of Pharmacy, announced the discovery of an alkaline principle, which he styles *lobelina*. It has a highly acrid, burning taste, and unites with most of the acids, except the acetic. In a subsequent communication, he mentions that one-fourth of a grain of *lobelina*, in solution, caused violent vomiting and much prostration in a cat. In larger quantity, narcotic effects were strikingly manifested.*

The latest and most complete examination of the *Lobelia inflata* was published by Reinsch, in 1843. He confirmed the opinion of several others preceding, that a substance found by him, and which he styled *lobeline*, was the active principle, but he did not obtain it in a pure state. M. Bastick announces that he has succeeded in this matter. We do not copy the process followed, but may state that it is similar to that advised by Liebig for obtaining hyoscyamine.

Indeed, it seems to resemble this last substance, except that it does not crystallize. It is a vicious, transparent oil, with a strong alkaline reaction, and possessing, when pure, the odor of the plant in a feeble degree; but when ammonia is added, the smell is strong and analogous to that of tobacco. If taken in small quantity, it acts like large doses of the plant. It is, therefore, without doubt, a violent poison.†

Pastinaca sativa, L., (Wild parsnip.) The root of this plant is said by Murray to have produced delirium, vertigo, heat at the stomach, and in the mouth and eyes, with tumefaction of the lips. It is a native of the United States.‡

Hydrocotyle vulgaris, Mx., (Marsh pennywort.) This plant has an acrid taste. It is a native of the United States.

* Philadelphia Journal of Pharmacy, vol. v. p. 300; vol. ix. p. 98; vol. xiii. p. 10. For notices of its medical uses, see Dr. Bailey, in Transylvania Medical Journal, vol. x. p. 421. Dr. Coates, in Med. Examiner, vol. i. p. 64.

† Gazette des Hôpitaux, July 12, 1851, from the Journal de Chimie Médicale.

‡ It would seem probable, from two cases related by Dr. Vedder, in the American Medical Intelligencer, vol. ii. p. 214, that the leaves of the *garden parsnip* will produce an erysipelatous inflammation of the skin.

Phytolacca decandra, L., (Poke. Pigeon berries.) A native of the United States. Its juice is acrid, and acts as a violent emetic and purgative. Prostration and convulsions have been induced by it. On a dog, to whom two ounces of the liquor distilled from the berries were given, Dr. Schultz, of Pennsylvania, found it to produce nausea and drowsiness, with slight spasmodic motions, but no vomiting. This last is, however, a common effect.*

Calla palustris, L., (Water arum.) A native of the United States. The root of this plant has a burning taste.

Arum maculatum, L., (Wake robin.) *A. dracunculus*, L., *dracontium*, L., *tryphillum*, L., *trilobatum*, L., and other species. The third and fourth are natives of the United States.

These are all acrid, and have produced dangerous effects. When the fresh root of the *A. maculatum* was given by Orfila to dogs, they died at the end of from twenty-four to thirty-six hours, without any other symptom than dejection, and the digestive canal was found somewhat inflamed. Bulliard relates the following case: "Three children ate of the leaves of this plant. They were seized with horrible convulsions, and with two of them all assistance was unavailing, as they could not be made to swallow anything. They died; one at the expiration of twelve days, and another at the expiration of sixteen. The third was saved with difficulty. Its tongue was greatly swelled, and hence deglutition was painful and difficult."†

Sambucus ebulus, L., (Elder.) Dr. Christison saw a case of poisoning in a boy, from eating the flowers and leaves. In a few hours he was seized with griping and great tenderness of the abdomen, and these continued for three days, when medical advice was asked. It was now found to be a case of enteritis, which required active treatment, and on the fifth day from eating the leaves he passed them by stool. Another boy, who had eaten the flowers only, suffered with severe narcotic symp-

* Bigelow's American Medical Botany, vol. i. p. 48. From an analysis of Mr. Donelly, (American Journal of Pharmacy, vol. xv. p. 165,) it would seem that no peculiar acrid principle can be detected in this plant. See also, *ibid.*, vol. xv. p. 81.

† Orfila's Toxicology, vol. ii. p. 83.

toms, and particularly giddiness.* The *S. nigra*, L., (dwarf elder,) has undoubtedly similar properties.

The *treatment* in cases where vegetable acrid poisons have been taken must be directed to the removal of the noxious substance, unless spontaneous vomiting occur. Emetics are hence required in some cases. The diarrhœa consequent on irritation and inflammation of the mucous membrane of the intestines must be considered as an active disease, and requires the antiphlogistic regimen. The most difficult and dangerous cases are those in which there is a general prostration.

ANIMAL IRRITANTS—CANTHARIDES.

Cantharis vesicatoria, (Spanish fly.) Cantharides, according to Robiquet, consists of various substances: a green fluid oil; a black matter, soluble in water and insoluble in alcohol; a yellow matter, soluble in both; a fatty matter, insoluble in alcohol; phosphates of lime and magnesia; acetic and uric acids. None of these are vesicatory, but the epispastic principle is a white crystallizable substance, insoluble in water, (soluble, however, in it, when mixed with the yellow matter,) soluble in boiling alcohol and the oils. This is styled *Cantharidin*.†

We are, however, to treat of it as ordinarily administered,

* Edinburgh Medical and Surgical Journal, vol. xxxiii. p. 73. A similar case (fatal) by Dr. Schollmeyer, is related in London Medical Gazette, vol. xxxv. p. 96.

† Orfila's Toxicology, vol. ii. p. 422. The experiments of Robiquet are quoted in detail in the Eclectic Repertory, vol. ii. p. 405. Previous to the examination of Robiquet, I believe, Beaupoil had made some imperfect researches. (See his *Recherches Medico-Chimiques*.) For the latest observations on Cantharidin, see Carpenter, in Silliman's Journal, vol. xxi.; Thierry, London and Edinburgh Philosophical Magazine, vol. vi. p. 318; Nardo and Pullino, British and Foreign Medical Review, vol. ii. p. 549. According to these last, two grains of cantharidin, given to a rabbit, caused paralysis, coldness, and death in three hours. Dr. Paris states that boiling the Spanish fly in water deprives it of its power of acting on the kidneys, (strangury,) but does not diminish its vesicating powers. This has been confirmed by Dr. Beatty, of Philadelphia. (Philadelphia Journal of Pharmacy, vol. iv. p. 185.)

viz., in the form of powder and of tincture, and the usual symptoms are a disagreeable, nauseating smell, acrid taste, retchings, copious vomitings, which are often tinged with blood; alvine evacuations, more or less bloody; burning heat in the stomach and other parts, accompanied with griping and excruciating pains; great heat in the bladder, difficulty in making water; the urine often bloody, sometimes totally suppressed; obstinate, and sometimes painful and excessive priapism; satyriasis; the pulse frequent and hard; while, in some cases, the jaws are closed; and convulsions, general rigidity of the limbs, and delirium, precede the death of the patient.* All of these, however, are not always present, and very frequently "no venereal appetite is excited, sometimes even no affection of the urinary or genital organs at all, and the kidneys and bladder may be powerfully affected without the genital organs participating."†

In many instances this substance has been administered with a view to stimulate exhausted passion, or to accomplish the seduction of females. It will be seen from the above remarks, and from subsequent cases, how incorrect the common opinion is.

Julia Fontanelle relates the case of a person who, by mistake, took half an ounce of powdered cantharides. The result was burning pain in the throat, vomiting, ardor urinæ, and, in a few hours, bloody urine and priapism. By the use of appropriate remedies, continued for some days, these symptoms gradually diminished; but it was a fortnight before he could leave the hospital.‡

Other cases are quoted by Dr. Christison, from Biett and Rouquayrol. In these, in addition to the more common symptoms, there was difficulty of swallowing and violent tenesmus; and in the last much salivation, and toward the end of the second day a large cylindrical mass of the inner membrane of the gullet was discharged by vomiting.§

* Orfila's Toxicology, vol. ii. p. 430; Le Clerc, p. 74; New England Journal, vol. xi. p. 18.

† Christison, p. 535.

‡ Medico-Chirurgical Review, vol. viii. p. 272, from Revue Médicale.

§ Christison, Edinburgh Medical and Surgical Journal, vol. xxxiv. p. 214. This patient was a fortnight in recovering.

Four laborers, who found a flask of tincture of cantharides in a warehouse, and drank it for spirits, were seized with great heat and pain of the alimentary canal, vomiting of blood, impossibility of swallowing, a frequent, small pulse, and coldness of the extremities. Dr. Graaf, of Cologne, who visited them, used antiphlogistic and emollient remedies with success, but a distressing strangury continued in two of them for several days. One of the four, after being relieved of the strangury, was seized on the eighth day with severe nephritis and raving delirium, which required depleting remedies, cold applications to the head, etc.*

Dr. Ives, of New York, relates the case of a youth, aged seventeen, who, in a paroxysm of anger, swallowed an ounce of the tincture, supposing it to be laudanum. He was seen in an hour and a half afterwards. The respiration was hurried; there was profuse ptyalism, convulsive trembling, acute pain in the regions of the stomach and bladder, and such exquisite sensibility that the slightest pressure produced convulsions. Emetics and venesection were used, followed by mucilaginous drinks and castor oil. The convulsions occurred occasionally, accompanied with painful priapism. The proper remedies were continued, and although delirium interposed for a time,

* London Medical and Physical Journal, vol. xlvii. p. 437, from Hufeland's Journal. In a case that occurred to Mr. Snow, after the early symptoms were removed, inflammation of the kidney supervened on the third day. (Lancet, N. S., vol. xxvii. p. 733.) Two cases are related by Mr. Williams, of Bewdly, (Midland Medical and Surgical Reporter, vol. ii. p. 360,) where the ordinary affections of the stomach and bladder occurred from taking some of the powder in raspberry brandy.

Mr. Maxwell relates, in the Jamaica Physical Journal for May, 1835, of three negroes, who each took by mistake a drachm of the powder, which had been macerated in rum. They ate hearty suppers afterwards, but burning heat of the throat and nausea soon followed, and in two hours these were succeeded by retching and vomiting of blood, mucus, and froth. The kernels of the *seuillia cordifolia* were given as an antidote, and they acted as a violent emetic. On the next day, there was heat of the throat, difficulty of swallowing, and profuse salivation. They were bled and blistered, and enemata of castor-oil administered. Strangury followed in all, according to Mr. Maxwell, long before the blisters could have caused it. The salivation also continued for some time, but they all finally recovered. (American Journal Med. Science, vol. xvii. p. 253.)

he appeared gradually to recover. On the seventh day, however, after taking it, he was seized with pain in the head, trembling, and universal spasms: coma followed. From this again he revived, and appeared to improve; but on the fourteenth day violent convulsions recurred, followed by insensibility and death.*

There are two cases recorded, in which the administration of this substance was made the subject of a criminal prosecution in Great Britain: One (for the reference to which I am indebted to Dr. Paris) occurred in the reign of Elizabeth. One Vaux recommended its use to an impotent person, who died in consequence on the twenty-sixth day after taking it. Vaux, although he plead that he was not present at the taking of it, was found guilty, and sentenced to be hung.†

The other case occurred in 1825: A drachm of the powder had been given in some ale. It caused immediate vomiting; but ulceration of the tongue and throat, with copious salivation, pain, and frequent desire to urinate, with febrile symptoms, succeeded. The patient, however, recovered. On the trial, Dr. Dyce, of Aberdeen, stated that he had given ten grains of the powder of cantharides at a dose as a medicinal prescription. The criminal was convicted.‡

The following French case is curious, from the repeated attempts made to destroy life. The accused was a man aged forty-one years, a carpenter by trade, and of an appearance, gestures, and conversation nearly verging to idiotism. His attempts were made on a step-brother, named Hervonet.

During May, 1846, Hervonet, shortly after eating some soup, which tasted extremely bitter, was seized with violent pain in the stomach and bowels; he could not pass urine but with extreme pain, and the quantity discharged was small and

* American Journal of Med. Sciences, vol. i. p. 368. Mr. Pereira refers to this case, among others, as showing that the nervous symptoms sometimes do not exhibit themselves until after several days. In Dr. Ives' case, it was fourteen days; in the one by Graaf, eight; and in the one related by Guilio, three days. (London Med. Gazette, vol. xvii. p. 626.)

† 4 Coke's Reports, p. 44.

‡ Dr. Torrie, London Medical and Physical Journal, vol. liv. p. 463.

bloody. After suffering several hours, he was enabled to sleep, and on waking found himself much better.

He had no suspicion of the cause of this illness, but during the night of the 5th of July he was seized with similar symptoms. Two hours previous he had eaten soup of similar bitterness to the last. This time his sufferings were more severe and longer continued, and they only yielded after copious draughts of oil and sweet milk, which excited copious vomiting. Even yet he had no idea of any intent at poisoning.

On the evening of the 12th of July he found in his soup a black substance, which at first he supposed to be fragments of vegetables. A portion of this adhered to his palate; he detached it with his finger and examined it by the light, but could discover nothing certain, except that the taste was precisely similar to that experienced in the two previous instances. The next morning he was impressed with the idea that it was cantharides, and all doubt was removed on showing it to M. Drew, a medical man, who also informed him that two days previous he had seen his step-brother purchasing medicines from an apothecary.

Hervonet denounced his brother to the authorities; and as soon as Poirier heard of the charge, he fled, but was soon retaken. He confessed that he had purchased a blistering plaster on the 10th of July, and mentioned where he had hid it. On obtaining it all the plaster was found scraped off. It was also proved that he had made several purchases of the same nature, and an apothecary deposed that one of the plasters sold contained two grammes of cantharides.

The character of Poirier was proved to be extremely bad—a thief, of idle, loafing habits, and a burden to his relatives. His father, aged eighty, had given his property to his son-in-law and daughter, leaving Poirier only an allowance.

The jury found him guilty, and he was condemned to death; but scarcely had sentence been pronounced, before eleven of the jurymen united in a petition for a commutation of punishment. His apparent idiocy seems to have been the ground for this.*

* Gazette des Tribunaux, August 29, 1846.

The external application of cantharides sometimes gives rise to similar consequences, but in a more mitigated form.*

As to its effects on animals, Orfila found that when injected in the form of tincture into the jugular veins, it produced vertigo, stupor, and death. The blood in the left ventricle of the heart was fluid and reddish; that in the right was black, and contained coagula. On using alcohol alone, however, he observed precisely the same effects. He then tried oil digested upon cantharides. The animal was soon deprived of sensibility and muscular power, and tetanus, convulsions, difficult respiration, and death supervened. The lungs were found very bulky, and distended with a great quantity of reddish serosity; in some parts they were livid and compact. The mucous membrane of the bladder was slightly red, while that of the stomach and duodenum was natural. When cantharides in powder were introduced into the stomach, they produced vomiting, the discharge of much bloody mucus, pain, great dejection, extraordinary insensibility, and death. The mucous membrane of the stomach was of a fiery red; that of the duodenum less so, but also inflamed. The bladder was sometimes seen inflamed and thickened, and the œsophagus also was occasionally inflamed.†

As to the appearances on dissection, in man, they are generally similar to those from other irritant poisons—inflammation of the stomach and intestines. Fungous tubercles, erosions, and small ulcerations have also been noticed in these parts; the bladder has been inflamed or ulcerated, and in some cases the external organs of generation have been gangrenous.

In a fatal case mentioned by Orfila, where the powder had been taken for the purpose of suicide, the brain was gorged with blood; the omentum, peritoneum, gullet, stomach, intestines, kidneys, ureters, and internal organs of generation were inflamed, and the mouth and tongue were stripped of their lining membrane.

* A fatal case, in which blistering ointment was applied instead of sulphur ointment for the itch, is given by Taylor, (Poisons, p. 513.)

† Orfila's Toxicology, vol. ii. p. 424.

In Dr. Ives' case, the brain exhibited a similar appearance. The mucous membrane of the stomach was whiter than usual, pulpy, and easily detached. The kidney was also inflamed.*

If, on dissection, or in the matter vomited, any portion of this poison remain, it may be detected by its shining points, which are of a beautiful green color. This, however, can only be hoped for when it has been taken in the form of powder. When the tincture has been administered, we cannot expect to identify the substance, and must rely solely on the symptoms and the dissection.

Barruel was recently requested to examine some chocolate, by which a whole family had been made very ill. On the first view, it exhibited, when held in the light of the sun, numerous shining spots. He, however, tested it for mineral poisons, but could detect none. He then treated some of the powdered chocolate with sulphuric ether, and applied heat to the mixture; it was then filtered and evaporated. The whitish matter obtained blistered the lips; and it presented the brilliant points so common in the powder of cantharides. To render the fact more certain, he applied some of the adulterated chocolate to his arm by means of a compress; in six hours it drew a blister.†

Treatment. Oil is recommended by Orfila, but later experiments have demonstrated its injurious effects. According to Dr. Pallas, it increases the danger. Cantharides, macerated in cold oil, and afterwards given to dogs, was found to destroy them in a few minutes,‡ and this is owing to the fact that cantharidin is soluble in oil. Mucilaginous drinks are preferable, to excite vomiting and to diminish the irritation in the bladder. The warm bath, frictions and diluents are proper, as also enemas of camphor and opium. Devergie considers camphor in the light of an antidote, and strenuously advises its use not only in

* An interesting case, supposed to be of poisoning by cantharides, but probably referable to internal disease, is related by Dr. Hastings, in the *Transactions of the Provincial Med. and Surgical Association*, vol. i. p. 402.

† *Annales d'Hygiène*, vol. xiii. p. 455. For additional cases, see *Edinburgh Med. and Surgical Journal*, vol. lxii. pp. 562, 563; *Medical Gazette*, vol. xxix. p. 63; vol. xxxix. p. 855.

‡ *London Medical Repository*, vol. xix. p. 259; *Quarterly Journal of Foreign Medicine and Surgery*, vol. v. p. 304.

the above form, but also in solution with alcohol, externally applied by friction.*

The antiphlogistic treatment is required, when, as is usually the case, appearances of inflammation present themselves. But it is now conceded, I believe, that bleeding should be delayed as long as possible, as it probably favors the absorption of the poison. This idea was first advanced by Magendie, and its correctness would seem to be verified by some of the cases which I have cited.

The *Lytta vittata*, (*Meloe americana*, potato-fly,) and the many other allied species of our own country, appear to possess properties analogous to cantharides.† Some European insects have a similar character, as one or two species of *Bombyx*, and the *Mylabris variabilis*, or *chicorei*. Bretonneau found in this last a vesicating principle, identical probably with cantharidin.‡ It has long been used in China as an epispastic.

POISONOUS SERPENTS.

On these I intend to be very brief, and shall merely give a short notice of those that are found poisonous in other coun-

* A case illustrating the beneficial effects of camphor and opium is given by Dr. Cheeseman, in *New York Journal of Medicine*, vol. iv. An ounce of the tincture had been taken. See also the *Chemist*, vol. iv. p. 84.

Dr. Mulock, of Dublin, states that in three cases of strangury, caused by blistering with cantharides, he found the solution of caustic potash a perfect remedy. Two of the cases were head affections, where opium was inadmissible. Thirty drops given in half a wineglass of water every hour, gave relief before the third dose was exhibited. "What led me to the use of this preparation was its known effects in relieving the stings of wasps or bees, when applied to the skin. I considered that it might also relieve the acrid principle of the cantharides." (*Dublin Quarterly Journal*, August, 1848.)

† See the papers of Dr. Chapman, and Dr. Woodhouse, in the *New York Medical Repository*, vol. ii. p. 163, vol. iii. p. 213; of Dr. Schott, in *Eclectic Repertory*, vol. ii. p. 193; of Dr. J. F. Dana, in *Silliman's Journal*, vol. ii. p. 137—this contains an analysis of the potato-fly, showing that cantharidin exists in it. For an account of the numerous species found in this country, see *New England Journal*, vol. xiii. p. 243; *Say's Entomology*, and his paper on the *Coleoptera*, in vol. iii. of the *Journal of the Academy of Natural Sciences*; Dr. Barton's *Materia Medica*; and Durand, in *Philadelphia Journal of Pharmacy*, vol. ii. p. 276.

‡ *Bulletin des Sciences Médicales*, vol. xiv. p. 92.

tries. Somewhat more of detail will be proper in reference to such as are peculiar to the United States.

The viper (*Coluber berus*, *Vipera berus*,) is the most common poisonous serpent of England and the European continent. Its bite is not uniformly fatal to man or the larger animals, but the season of the year appears to increase its intensity, being most venomous in summer. The symptoms are acute pain in the part wounded, which extends over the limbs, and even to the external organs; tumefaction and redness, which afterwards passes to a livid color; syncope; frequent, small, concentrated and irregular pulse; difficulty of breathing; copious and cold sweats; disturbance of vision and of the intellectual faculties; bilious and convulsive vomitings, and followed generally by yellowness of the skin. Gangrene is apt to occur in the wound when the disease is about to terminate.*

The *poisonous snakes of India* have been noticed by Russel, and his experiments are still the most valuable we have on the subject.† Notices are interspersed in abundance in various literary and scientific works, concerning the venomous serpents of other countries.‡

In general, the animal is most poisonous, and its effects most rapidly destructive, in warm climates. Hence the serpents of India and South America are distinguished above all others for their venom.

* On the effects of the venom of the viper, see Morgagni, vol. iii. p. 410; Orfila's Toxicology, vol. ii. p. 380; Edinburgh Medical Essays, vol. vi. p. 420; Fontana, in Philosophical Transactions, vol. lxx. p. 163; Redi, in do., vol. i. p. 160; Atwell, in do., vol. xxxix. p. 394. Also London Medical Repository, vol. xiv. p. 522—Configliacchi's experiments; New England Journal, vol. vi. p. 311—Mangili's experiments.

† An analysis of these is contained in Orfila's Toxicology, vol. ii. pp. 387 to 403. See also the Eclectic Repertory, vol. ii. p. 318; and Dr. Rankin's experiments, in Edinburgh Medical and Surgical Journal, vol. xviii. p. 231. Also, the Asiatic Researches, and Transactions of the Medical and Physical Society of Calcutta.

‡ An extraordinary case is related by Dr. Pascalis, in the New York Medical Repository, vol. xix. p. 78, of an individual who was bitten by a snake at St. Domingo. He survived the effects many years, but the leg and thigh swelled to an enormous size, and so remained until his death. The only relief he experienced, was to open one or other of the capillary vessels on the swelling, and discharge four or five ounces of blood from it.

Dr. Harlan, in his *Genera of North American Reptilia*, enumerates the following as the poisonous serpents of this country :—

Crotalus durissus, Banded Rattlesnake. Northern and Middle States.
Crotalus horridus, Diamond Rattlesnake. Southern States, Antilles.
Crotalus miliarius, Ground or Little Rattlesnake. Southern States.
Crotalus confluentis, Say. Rocky Mountains.
Crotalus tergeminus, Say. Western Territories.
Cenchrus moccason, Daudin. Hog-nose snake, Moccason.
Viper fulvia. Southern States.
Scytalus piscivorus, Water Viper. South Carolina.
Scytalus cupreus, Rafinesque. Copper-head, Copper Adder. *Cenchrus moccason* of Say. Eastern and Middle States.
Scytalus tisiphone. Carolina.*

To these Dr. Troost has added as poisonous :—

Toxicophis (Acontias) leucostoma. Cotton-mouthed snake, a water-snake. Tennessee.
Toxicophis atrofuscus. Highland Moccason, Tennessee.†

Crotalus horridus, and *durissus*. (The rattlesnake.) This is probably the most venomous snake known in our country, but its effects vary greatly; doubtless, as has been suggested by Sir Everard Home, owing to the greater or less intensity of the poison.

“When the poison is very active, the local irritation is so sudden and violent, and its effects on the general system are so great, that death soon takes place. On examination after death, the only alteration of structure met with is in the parts

* Journal of the Academy of Natural Sciences of Philadelphia, vol. v. p. 364, etc. Harlan's Researches, p. 127, etc. Dr. Holbrook, in his valuable work on the Herpetology of the United States, has described some of the above under different names.

<i>Crotalus horridus</i> ,	<i>Crotalus adamanteus</i> .
<i>Vipera fulvia</i> ,	<i>Elap fulvius</i> .
<i>Scytale piscivorus</i> ,	<i>Trigonocephalus piscivorus</i> .
<i>Scytale cupreus</i> ,	<i>Trigonocephalus contortrix</i> .

A writer in Sillman's Journal suggests whether the *Massasauga* rattlesnake is not the *Crotalus miliarius*. It is found in swamps in Ohio, twelve or fourteen inches long and of a proportionate thickness, with usually three or four rattles. It is quite venomous. (Sillman, vol. xxxi. p. 32.) It is also found in the swamps near Buffalo.

† Annals New York Lyceum, vol. iii. p. 176.

close to the bite, where the cellular membrane is completely destroyed, and the neighboring muscles are very considerably inflamed.

“ When the poison is less intense, the shock to the general system does not prove fatal. It brings on a slight degree of delirium, and the pain in the part bitten is very severe; in about half an hour swelling takes place from the effusion of serum in the cellular membrane, which continues to increase with greater or less rapidity for about twelve hours, extending during that period into the neighborhood of the bite; the blood ceases to flow in the smaller vessels of the swollen parts; the skin over them becomes quite cold; the action of the heart is so weak that the pulse is scarcely perceptible, and the stomach is so irritable that nothing is retained on it. In about sixty hours, these symptoms go off; inflammation and suppuration take place in the injured parts; and when the abscess formed is very great, it proves fatal.* When the bite has been in the finger, that part has immediately mortified. When death has taken place under such circumstances, the absorbent vessels and their glands have undergone no changes similar to those from other poisons, nor has any part lost its natural appearance, except those immediately connected with the abscess.”

In those patients who recover, the symptoms go off more readily and completely than those produced by a morbid poison which has been received into the system.†

A case is related by Sir Everard Home, which illustrates the above views: Thomas Soper, aged twenty-six, was accidentally bitten twice in the hand by a rattlesnake. The snake was kept for the purpose of exhibition in London.

The first symptom observed was an incoherence in language and behavior, resembling intoxication. In less than half an hour the hand began to swell; next the forearm; and after-

* A case strongly illustrative of this class of symptoms is related by Mr. Breithaupt, of Philadelphia, the actual sufferer himself, in the *Philosophical Transactions*, vol. xlv. p. 147. He survived the bite and recovered; but an abscess formed several months afterwards in the injured part.

† Home, in *Philosophical Transactions* for 1810; *Eclectic Repertory*, vol. i. p. 320.

wards the pain extended to the axilla. In two hours after the bite Mr. Brodie saw him. The skin was cold; the man's answers were incoherent; his pulse one hundred in a minute; and he complained of sickness. Ammonia and ether were exhibited internally, and applied to the wound. He rejected the first draught, but retained the second. Fits of fainting supervened, with coldness of the skin. Next day blood was extravasated under the skin as low as the loins, and vesications had formed on the wounded arm. Depressions and faintings continued. These symptoms were present for several days, with greater or less severity. The arm sloughed in various places, and abscesses formed, accompanied with purging. Finally, mortification and delirium occurred, and he died on the 4th of November, 1807, eighteen days after being bitten.

On dissection, the body externally was found natural, with the exception of the arm that had been bitten. The wounds made by the fangs were healed; the lungs were healthy; the cavities of the heart contained coagulated blood; the cardiac portion of the stomach was moderately distended with fluid, while the pyloric portion was much contracted; the internal membrane had its vessels very turgid with blood. The intestines and liver were healthy. The vessels of the brain were turgid, and water was effused in it.*

Mr. Drake, a person who took rattlesnakes from this country for exhibition in England and France, was unfortunately bitten by one in Paris. He died in nine hours. On dissection, all the internal organs were found healthy, except that the membrane covering the brain and spinal cord had a reddish tinge, and the venous blood on the affected side was curdled or clotted.†

Dr. Harlan, in a case where death ensued in about twenty-four hours, found the usual external appearances, the blood-vessels of the head filled, the spinal cord healthy, the mucous membrane of the stomach of a red pink, owing to the loaded state of its vessels, and marks of inflammation in the mucous membrane of the intestines.‡

* Eclectic Repertory, vol. i. p. 312.

† Edinburgh Journal of Science, vol. vii. p. 86.

‡ American Journal of Medical Sciences, vol. viii. p. 397.

The effects of the bite of the rattlesnake on animals are so well known, and in general resemble so closely those produced on man, that it is not necessary to recapitulate them.*

The moccason and copper-head snakes are equally poisonous with the rattlesnake.†

As to antidotes, and the treatment proper for bitten persons, we may remark that these are numerous and diversified. Humboldt and Bonpland mention a New Grenada plant, the *Guaco*, (Mikana guaco,) the juice of which seems to deter snakes from biting persons on whom it is applied, and even when they are bitten, the application of the leaves prevents the usual effects.‡

Arsenite of potash (Fowler's solution) has been used with great success by Mr. Ireland, in the West Indies, to counteract the effects of the bites of snakes.§ The pill of Tanjore, also an arsenical preparation, was sometimes used by Dr. Russel with apparent success on animals; but several, however, to whom it was administered, died as if nothing had been taken.||

Ammonia and *Eau de Luce* have many testimonies in their favor; while some, as Sir Everard Home and Orfila, doubt their specific virtues.¶ They are, however, useful in promoting

* See, on this point, Philosophical Transactions, vol. xxxv. pp. 309, 377. Dr. B. S. Barton mentions two cases of rabbits bitten by rattlesnakes. One recovered gradually in three days, the other died in seventy-four minutes. On dissection, the great curvature of the stomach was seen inflamed. Around the bite blood was effused, and the solids were in a gelatinous, bloody state. (Barton's Medical and Physical Journal, vol. i. part 1, p. 167.) Harlan, in American Philosophical Transactions, N. S., vol. iii. p. 300.

† Cases are given by Dr. Brickell, in New York Medical Repository, vol. viii. p. 441; by Dr. Drake, (cured by cupping and ammonia,) in Western Journal of Medical and Physical Sciences, vol. i. p. 60.

‡ Orfila's Toxicology, vol. ii. p. 441. See also a translation of a Spanish tract on this plant, from the Jamaica Physical Journal, in United States Medical and Surgical Journal, vol. i. p. 66; Silliman's Journal, vol. xxiv. pp. 280, 388; vol. xxvii. p. 171. Some interesting facts relative to the beneficial effects of the guaco, are quoted in Lancet, N. S., vol. xxv. p. 497.

§ Medico-Chirurgical Transactions, vol. ii. p. 396.

|| Orfila's Toxicology, vol. ii. p. 446. See also, New York Medical Repository, vol. vii. p. 12; Dr. Phillips, American Journal of Medical Sciences, vol. viii. p. 540; Dr. Miller, of Ohio, Boston Medical and Surgical Journal, vol. ix. p. 240.

¶ Testimonies in favor of these may be found in the Medical Commentaries,

perspiration. Alcohol, in large and repeated doses, (in the form of whisky, etc.,) has also been used.*

Many plants have acquired a temporary reputation in our own country and in South America. Of the former are the *Aristolochia serpentaria*, *Prenanthes alba*, and *Polygala senega*; and in South America, the *Eupatoria ayapana*, the *Algalia* or *Yerba del sapo*, and the *Raiz preta*.†

The *Uvularia grandiflora* has very decisive testimony in its favor,‡ and the *Hieraceum venosum* has lately been offered as an antidote, but its effects are not superior to many other plants already noticed.§

vol. xiv. p. 297; London Medical Repository, vol. viii. p. 73; New York Medical Repository, vol. ix. p. 109; Edinburgh Medical and Surgical Journal, vol. xviii. p. 231; London Medical and Physical Journal, vol. xxix. p. 120; Dr. D. Ramsay, a case cured by ammonia. Tilloch's Philosophical Magazine, vol. xvii. p. 125. Numerous cases of the bite of the rattlesnake and moccason, are said to have been cured by ammonia, by Dr. Moore, of Mississippi, and Dr. Heustis, of Alabama. (American Journal of Medical Science, vol. i. p. 341; vol. viii. p. 83.) Mr. Sievwright, in India, London and Edinburgh Monthly Journal, vol. ii. p. 257.

* See two cases of the bite of the rattlesnake, cured by it, in American Medical Recorder, vol. vi. p. 619.

† Dr. Brickell states that *Prenanthes alba* is a famous Indian cure for the bite of serpents. (Barton's Medical and Physical Journal, vol. ii. part 1, p. 101.) On the *Prenanthes altissima*, (*Harpalyce altissima* of Don,) see Dr. James Hubble, New York Medical and Physical Journal, vol. iv. p. 484.

Dr. Barton's paper in the American Philosophical Transactions, vol. iii. p. 100, contains a long list of supposed vegetable antidotes.

On the *Eupatorium ayapana*, see New York Medical Repository, vol. vii. p. 16; and Tilloch's Philosophical Magazine, vol. xxi. p. 286.

On the *Algalia*, New England Journal, vol. iii. p. 322.

On the *Raiz preta* (*Chiococca racemosa*, *Kahinea*,) of Brazil, Edinburgh Philosophical Journal, vol. i. p. 218; Dr. S. L. Mitchell, New York Medical and Physical Journal, vol. viii. p. 208; Spix and Von Martius' Travels, vol. ii. p. 131. Dr. Baxter, of New York, has translated the chemical researches of Pelletier and Caventou on this substance. (New York Medical Journal, vol. i. p. 164.)

‡ See Mr. Tracy's paper, in the Transactions of the Albany Institute, vol. i. p. 32. (New York Medical and Physical Journal, vol. vii. p. 65.) Dr. B. H. Coates, on the *Uvularia perfoliata*, in Silliman's Journal, vol. xxxv. p. 270.

§ See Dr. Harlan's experiments, in the Transactions of American Philosophical Society, N. S., vol. iii. pp. 300 and 400. Dr. Harlan mentions that the State of South Carolina bought from a negro the secret of a supposed

Caustics are valuable, but often prove ineffectual, and the treatment at present most relied on is the use of *cupping-glasses* and the application of ligatures above the part bitten, but not too tight, nor too long continued. Then cauterize the wound with lunar caustic, and afterwards apply compresses to the part. Perspiration and sleep should be encouraged by doses of ammonia, wine, or ether, and the patient should be kept in bed, well covered. Local inflammation must be combated by the usual means.

Dr. Knox, in a very interesting paper on the bites of snakes, (particularly those of warm countries,) insists that the only certain remedy is *excision of the part*, and adduces instances of cure.*

Many cases, there is no doubt, would not prove fatal, if left to nature,—with, however, more or less local or diffuse inflammation.†

antidote, at the expense of his freedom and an annuity of £100. It proved to be the *Alisma plantago*.

Dr. Williams, of Massachusetts, has lately mentioned the *Viola ovata* as a cure. (*American Journal of Medical Sciences*, vol. xiii. p. 310.)

Dr. Daniel Drake mentions a case in which the root of the *sanicula marilandica*, applied in the form of poultice, cured the bite of a snake. (*Western Journal of Medicine and Surgery*, vol. v. p. 394.)

Dr. Butazzi, of Naples, cured an alarming case of viper-bite, by sulphate of quinine in large doses. (*Medico-Chirurgical Review*, vol. xxix. p. 509.) The application of oil of turpentine to the wound is also said to have proved successful in Brazil.

Besides these, many other remedies have apparently proved successful. Oil has been thus given. (*New York Medical Repository*, vol. ii. p. 242.) A living fowl applied to the wound. (*Silliman's Journal*, vol. i. p. 359.)

Most of these illustrate the remark of Sir Everard Home, that "the violent effects which the poison produced on the part bitten, and on the general system, and the shortness of their duration, have frequently induced the belief that the recovery depended upon the medicines employed."

* *Lancet*, N. S., vol. xxv. p. 199. See also Dr. William B. Diver, on the treatment of the bites of snakes, by the native practitioners of Bengal, in *American Medical Intelligencer*, vol. iv. p. 193. They use the actual cautery and incisions.

† I copy this remark from Dr. Harlan, who makes it at the conclusion of an interesting case, in *North American Medical and Surgical Journal*, vol. xi. p. 227. See also Hancock on snake poisons. (*Brande's Journal*, N. S., vol. vii. p. 330. The poison of serpents, (*echidnine*,) though noxious when introduced through a wound, appears to resist the absorption action of the stomach. Taylor on Poisons, p. 36; Galtier Fox, p. 8.

The *Scorpion* is most venomous in southern countries. Instances are recorded of its sting producing grievous local inflammation, and occasionally fever, trembling, and pain, on man, in France and Italy. Animals, as dogs and cats, generally survive, though some have died from its poison.*

The *Tarantula* produces similar effects, local rather than general, and the fabulous stories respecting it are now well understood and duly appreciated. It would seem, however, that there are species whose sting may prove fatal. Dr. Graperon states that he saw two fatal cases in the Crimea: one proved so in forty-eight hours, another in six days. The first was that of a peasant, who was stung while sleeping in his hut. The part was soon very painful, his neck swelled, and the respiration became difficult forty-four hours after the accident. On the right side of the neck there was a brownish-violet mark; the neck, head, and shoulders were swelled; and the thorax, from the clavicle to the false ribs, was of a bluish color. Scarifications, the actual cautery, oil externally and internally, and ammonia, were all tried in vain.†

The bite of the *Spider* is also said to cause local inflammation, with general irritation. Several severe cases are recorded.‡

The sting of the *bee*, the *humble-bee*, the *wasp*, and the *hornet*, have each occasionally produced dangerous and alarming symptoms. Inflammation, more or less extensive, has followed, and if the part injured be a sensitive one, great misery is produced. Several cases of this nature are recited by Orfila, and in a contemporary journal a remarkable instance is mentioned, where the sting of a bee excited vomiting, fainting, sweating, trembling, and great difficulty of breathing. The patient had

* Orfila's *Toxicology*, vol. ii. p. 411.

† *Quarterly Journal of Foreign Medicine and Surgery*, vol. i. p. 215.

‡ Dr. Jennings, *Coxe's Medical Museum*, vol. iii. p. 277. A fatal case, possibly from it, by Dr. Lawrence, in *Chapman's Journal*, vol. i. p. 259; case by Dr. Stahl, in *American Journal of Medical Sciences*, vol. xxii. p. 514; by Dr. Hulse, *ibid.*, vol. xxiv. p. 70.

There is a list of North American spiders, by Mr. Hentz, *Silliman's Journal*, vol. xxi. p. 103.

been stung on the back of the left middle finger, but it caused little pain and no swelling.*

A species of wasp (*Vespa crabro*, Yellow jacket,) stung a ploughman when at work. It caused insensibility and convulsive twitchings for several hours, nor did he recover until active stimulants were used.†

The sting of the scorpion, bee, or wasp requires, according to its violence, internal or external remedies. Generally, emollient, anodyne applications to the injured parts are sufficient to allay the irritation after extricating the sting. The volatile alkali is also a valuable medicine in severe cases.

Dr. Mease has collected several cases of death occurring in this country from the stings of bees, wasps, and spiders. He has a high opinion of the plantain juice, both taken internally and applied to the bitten part. Common salt moistened (he observes) has also been used with benefit.‡ In a recent instance large quantities of laudanum and ammonia were required in order to relieve the patient.§

A girl of the age of thirteen was bitten on her foot by the *arge green spotted lizard* of this country. Numbness, swelling of the limbs, followed by severe pain, succeeded; and after

* Orfila's Toxicology, vol. ii. p. 414; Edinburgh Medical and Surgical Journal, vol. viii. p. 130. See also Coxe's Medical Museum, vol. vii. p. 150; American Med. Recorder, vol. xi. p. 202; Silliman's Journal, vol. xvi. p. 182.

In the English Cabinet Annual Register for 1833 is the following, under the date of June 14: "Dr. King, of Stratford-on-Avon, died in consequence of a sting which he received on the eighth instant from a hornet."

Dr. Harris, in his lecture on POISONED WOUNDS, (Medical Examiner, vol. i. p. 250,) states his opinion that "in all instances where death results from the stings of bees or wasps, it arises from active inflammation, either in or about the larynx, so as to interrupt respiration."

† Dr. Littel, Western Journal of Medical and Physical Sciences, vol. iv. p. 192.

‡ Memoirs of Philadelphia Society for Promoting Agriculture, vol. v. p. 232; American Journal Med. Sciences, vol. xix. p. 265; Dunglison's Med. Intelligencer, vol. i. p. 183. We have accounts by most modern travellers in Persia of a poisonous insect in that country. It is now said to belong to the class of spiders. (Penny Magazine, 1837, p. 310; London Athenæum, 1837, pp. 671, 683.)

§ American Journal of Med. Sciences, vol. xxiv. p. 70. Ice applied to the stings has been found useful. Dr. Mettauer, in Boston Med. and Surgical Journal, vol. xxi. p. 265.

severe tetanic symptoms, the side became paralyzed, and death followed on the twenty-first day after the bite. If the result is actually to be ascribed to this, it will be the first case on record in this country.*

POISONOUS FISHES.†

Numerous cases are on record proving the poisonous nature of various species of fish, and particularly in the West Indies. Dr. Burrows has given a catalogue of such, which it may be useful to quote: *Balistes monoceros*, (*old wife*.) *Ostracion globellum*, (*smooth bottle-fish*.) *Tetraodon sceleratus*, (*tunny*.) *Tetraodon ocellatus*, (*blower*, or *blazer*.) *Muraena major*, (*conger-eel*.) *Coryphæna splendens*, (*dolphin*.) *Sparus chrysops*, (*porgee*.) *Coracinus fuscus major*, (*gray snapper*.) *Coracinus minor*, (*hyne*.) *Perca major* of Browne, (*Esox barracuda*, *barracuda*.) *Perca venenata*, (*rock-fish*.) *Perca venenosa* of Catesby, (*grooper*.) *Scomber maximus*, (*xiphias* of Browne, *king-fish*.) *Scomber thynnus*, (*bonetta*.) Another species of scomber, (*cavallœ*, *horse-eye*.) *Scomber cæruleo argenteus nudus* of Browne, (*Spanish*

* Dr. Cushman, of Maine, in Boston Med. and Surgical Journal, vol. xxi. p. 367.

† For the purpose of abbreviating my references, and at the same time giving a view of the authorities to which I have referred, I will cite the following papers on fish poisons: Dr. Chisholm, in Edinburgh Med. and Surg. Journal, vol. iv. p. 393; Dr. Burrows, in London Medical Repository, vol. iii. p. 445; Dr. E. Thomas, in Memoirs of the Medical Society of London, vol. v. p. 94; Dr. Meyer, in Barton's Medical and Physical Journal, vol. i. part 2, p. 43; Mr. Quarrier, in London Med. and Physical Journal, vol. xxv. p. 398; Mariner's Tonga Islands, vol. i. p. 309, London Edition; Mr. Anderson, in Philosophical Transactions, vol. lvi. p. 544; Orfila, vol. ii. p. 417; Dr. Dickson, in Annals of Philosophy, vol. xi. p. 462; Dr. Clarke, of Dominica, in Medical Facts and Observations, vol. vii. p. 294; Dr. Combe, of Leith, on the poisonous effects of the mussel, (*mytilus edulis*), Edinburgh Medical and Surgical Journal, vol. xxix. p. 86; Dr. Henderson, *ibid.*, vol. xxxiv. p. 317; Dictionnaire des Sciences Médicales, vol. xliii., art. *Poissons dangereux*, by H. Cloquet. Of these, the papers of Drs. Chisholm, Burrows, and Combe, are particularly deserving of perusal. Of later publications, I may refer to Moreau De Jonnes' paper on the poisonous fishes of the West Indies, Annales de Therapeutique et de Toxicologie, March, 1844, and Sir William Burnett's communication to the Royal Society, London, Edinburgh, and Dublin Phil. Magazine, August, 1846.

mackerel.) *Mormyra* of Browne, (*blue parrot-fish*.) *Clupea thryssa*, (*yellow-billed sprat*.) *Cancer astacus*, (*sea-lobster*.) *Cancer ruricolus*, (*land crab*.) *Mytilus edulis*, (*mussel*.)*

Of all these, the *clupea* (*yellow-billed sprat*) is the most active and dangerous; and the usual course of symptoms from it is the following: Itching over the whole body, violent colic pain, a contraction and pungent heat of the œsophagus, nausea, heat of the skin and great acceleration of the pulse, giddiness, loss of sight, cold sweats, insensibility, and death. Sometimes the disease is uncommonly rapid, convulsions ensue immediately after swallowing the fish, and death is a speedy consequence. Indeed, whites and negroes have both been known to expire at St. Eustatius, and other of the Leeward Islands, with the sprats in their mouths unswallowed.† This, however, is said to be the only fish which produces *immediate* death, even within the tropics.

The gray snapper produces cholera morbus and excruciating pain, with efflorescence, and is apt to leave a weakness of the lower extremities, dimness of sight, and dullness of hearing.

These are also the ordinary results, with, however, some variety, that are experienced from the use of the various kinds enumerated in the preceding catalogue. The contraction and heat of the œsophagus do not occur in some cases, but in its place there is an excessive heat of the mouth and tongue. A miliary eruption, or an efflorescence over the whole body, is also very common, producing sometimes an exfoliation of the epidermis.‡

The cause of this poison has been the subject of much ingenious research. Dr. Chisholm inclined to the idea that it was owing to the fish feeding on copper banks. He would seem, however, to have abandoned this, as, on chemical examination, a portion of the argillaceous stone of Antigua was found not to contain any; but a precipitate was obtained possessing the qualities of sulphate of barytes.§

* Various other species of poisonous fishes in other parts of the world are enumerated in the Edinburgh Encyclopedia, art. *Ichthyology*.

† Chisholm, p. 395.

‡ Thomas.

§ London Med. Repository, vol. v. p. 13.

Dr. Burrows has investigated this question with great ability. He is of opinion that the poison does not exist in the skin, or in the stomach and intestinal canal, or in the liver and gall-bladder exclusively, although there is no doubt that persons have been poisoned from eating these various parts. *It pervades the whole substance of the fish*, and this is abundantly proved by the statements of Dr. Chisholm, and the numerous authorities adduced by him. As to its origin, he discusses the cupreous theory of Dr. Chisholm, and shows the great improbability of the metal being held in solution in the sea-water. The fact also that land-crabs occasionally produce similar symptoms, is further urged against this opinion. The idea that other substances taken as food by fish may be the cause of their poisonous nature, is shown to be unfounded. He concludes with advancing and establishing the belief that a morbid change takes place in the system of the fish.

And this is particularly to be expected in those taken from the tropical seas, as they are immediately exposed to a high temperature, and putrefaction must commence with the extinction of life and proceed with intense rapidity.*

* Burrows. See also Cyclopædia of Practical Medicine, vol. iv., art. *Urticaria*, by Dr. Houghton.

I add the following, as it contains the observations of an acute and learned observer:—

“January 18, 1819. A paper was read by Dr. Ferguson, before the Royal Society of Edinburgh, ‘On the poisonous fish of the Caribbee Islands.’

“The author endeavored to prove, that in all the larger fishes of prey the poisonous quality was a rare and accidental occurrence, and that it was found to be present only at certain seasons of the year in one or two of the smaller species of fish, more particularly in the yellow-billed sprat, (the *Sardine doré* of the French, and *clupea thryssa* of naturalists.) From whence he inferred that the larger voracious fishes, such as the baracosta, (*Perca major* of naturalists,) etc., became poisonous only at the times they had recently been preying upon the smaller poisonous prey. The notion of their being made poisonous from being found in copper banks, or their eating the stinging blubbers, (the *medusæ* and *holothuriæ*,) was refuted. In regard to tests, it was shown that none could be depended upon; that nothing whatever could be discovered from inspection of the fish; that the boasted test of boiling a piece of silver with the suspected fish proved nothing, whatever might be its actual quality; that so far from there being any marks of disease in the viscera, or other parts of poisonous fishes, they were found to be in the best season, and of the highest quality in all respects.

Treatment. An emetic (of sulphate of zinc) or a cathartic should be immediately administered, according to the time that has elapsed since the ingestion of the poisonous substance. If, however, the spontaneous vomiting or purging be very great, it may sometimes be necessary to check it by anodynes. These are also proper when spasms supervene. And for the sequelæ, Dr. Chisholm advises a solution of alkalies in water. Sugar, containing a few drops of sulphuric ether, has also been recommended; and there are many cases in which the nervous system is so weakened as to need active and repeated stimuli.

Some of the fish taken on the coast of England would seem to possess injurious qualities. Thus the *trachinus draco* (weaver) has the power of stinging with its dorsal fin so violently as to cause numbness and violent swelling.*

"The poison of the yellow-billed sprat was supposed to be inherent in the animal at certain seasons of the year, and not occasioned by its being fed upon any undiscovered local marine poison, from the circumstance of the other smaller fishes that were found in the same place never partaking of the same poisonous nature, and from the poison of the fish being more potent and deadly than any known or even supposable article of food could be likely to communicate.

"With respect to remedies or antidotes, the efficacy of sugar was alone established as deserving of credit. Wines, spirits, and the condiments used at table, were believed to have obtained occasional credit, only being used in such slight cases of the poison as would likely have passed away without any remedy. As a precaution in all cases of suspicious fish of the larger species, the cleaning them out as soon as caught was recommended as a useful and proper one, to prevent the carcass being further tainted by the lodgment of any poisonous matter (such as that of the yellow-billed sprat) recently swallowed; though it was shown at the same time that the doing so, and even salting the fish afterwards, could not in any instance do away with the poisonous impregnation so communicated to these voracious creatures, whose powers of assimilation, from the shortness of the intestines and great size of the liver, must be supposed to be infinitely greater than among terrestrial animals. It was useful, also, in a more humble way, by furnishing the material of the only criterion hitherto discovered for detecting the poison, which was shown to be that of giving a portion of the liver or offal to some inferior animal, such as a cat, a duck, or a pig, and ascertaining its effects upon them, before making use of the fish." (Edinburgh Philosophical Journal, vol. i. p. 194.)

* Annals of Philosophy, N. S., vol. vi. p. 301; Christison, p. 541. Similar and even more severe results from its stinging, on the coast of Holland. It is asserted that no injury happens from it in warmer countries, as at Naples. Kesteloot, in Bulletin de l'Académie Royale de Bruxelles, vol. viii. part 2, p.

Mussels sometimes produce symptoms very analogous to those just related, and death has occasionally been the consequence in weak females and in children. Violent oppression and agony, swelling of the face, a scarlet efflorescence over the body, insatiable thirst, tormina, and vomiting, are the usual effects; and in fatal cases, coldness of the extremities, low and quick pulse, hiccough, delirium, and occasional coma.*

The most copious account that we have of these is by Dr. Combe, of Leith, as already quoted. In June, 1827, a number of persons (probably thirty) were seized in that town with similar symptoms, varying, however, in severity, from eating mussels. Heat and thirst, great desire to pass urine, small and weak pulse, some difficulty in swallowing, twitchings, and great weakness were the most common symptoms. Two aged persons died without being seen by medical men, but emetics and laxatives, followed by stimuli, relieved the disease in the rest.† The dissection of the above individual was hurried and imperfect. The abdomen in each was tympanitic, the stomach healthy, the intestines suffused in some places, and the bladder distended.

These mussels were collected from a bar at the dock-gates, which had floated there for twenty years, and on being drawn up, was found thickly incrustated with them. The wood was sound; the fish appeared fresh and healthy; nor could Dr. Christison discover any deleterious impregnation, after the most careful chemical examination. Dr. Combe agrees with Dr. Burrows in believing the cause to be a poison *sui generis* pervading the animal.‡

A case of choleroïd affection that occurred in London in

510. It is, however, improbable that the sharp spines of this and the other species of *Trachinus*, which inflict these wounds, throw out any poisonous secretion.

* Two fatal cases from eating mussels, by Dr. Burrows, in *London Medical Repository*, vol. iii. p. 445. Instances are also related in *Orfila's Toxicology*, vol. ii. p. 419; and *Foderé*, vol. iv. p. 85.

† One patient, however, had violent gastric symptoms, followed by peritonitis, which required the free use of the lancet. *Foderé* relates a similar case, which proved fatal, and on dissection the stomach and intestines were seen inflamed. (Vol. iv. p. 85.)

‡ *Edinburgh Medical and Surgical Journal*, vol. xxix. p. 86.

1833, is given by Dr. T. Thompson. It was accompanied with cramp or itching, but the patient sunk under it. On dissection, the mucous membrane of the stomach was bright red throughout, and a hemorrhagic spot at its pyloric extremity; the intestines had a similar appearance; the peritoneum was reddened. It appears that four days previous to his illness he had eaten a pint of mussels boiled for supper. The next day he was seized with great weakness, and diarrhoea soon followed.*

There are some instances in which the most severe asthma is present—the eruption appearing to give place to this. Dr. Dulong and some other French physicians have given ether in such, with success.†

The *oyster*, *lobster*, *crab*, and *mackerel* of our New York market have each occasionally produced poisonous effects.‡ Mr. Webster, Surgeon of the Chanticleer, says: “The mackerel of St. Helena is apt to produce unpleasant symptoms. Several of the officers on board the Chanticleer were attacked with violent headache, suffusion of the face, and scarlet rash on the breast, after having eaten of it; and I am informed that the same symptoms have been experienced in other ships.”§ Dr. G. Horner, in his Medical and Topographical Observations on Gibraltar, states that mackerel are caught in large numbers alongside vessels at anchor, and the eating of them is frequently followed by poisonous effects. “The mackerel, whether fresh or salt, causes the same symptoms. These are high fever, a flushed face, inflamed eyes, violent headache, and gastric disorder, with a sense of internal heat, continuing for a longer or shorter period, according to the person and the treatment. The

* London Medical Quarterly Review, vol. iii. p. 179.

† London Medical Gazette, vol. xix. p. 85. Mr. Bullock relieved a female ill with all the usual symptoms, by the free use of milk. M. Bouchardat suggested rather a novel cause for the poisonous qualities of mussels. He obtained by analysis, from them, a quantity of copper, “assez grande pour empoisonner.” (Annales de Hygiène, vol. xvii. p. 361.)

‡ A case of poisonous effects from a crab, supervening in fifteen minutes after eating it, is mentioned in the New York Medical Repository, vol. xii. p. 189. The newspapers (August, 1835,) contain an account of twelve persons in Maryland, dead after a repast on crabs.

§ Webster's narrative of a voyage to the South Atlantic under the command of Capt. Henry Foster, vol. i. p. 378.

most effectual remedy was an emeto-cathartic of tartrite of antimony and sulphate of magnesia. The cause of this fish poisoning is unknown.”*

Some years since a quantity of oysters arrived in the month of September at Dunkirk, from Normandy. They were extensively purchased and eaten; and colic, diarrhœa, and cholera morbus immediately prevailed to a great extent. It was supposed that the oysters were the cause, and Dr. Zandyck was commissioned to inquire into the subject. He found that many of these animals contained water which left a slimy deposit, and had a decidedly brackish taste; and he suggested that the mischief might be owing to the weakness and languor of the oyster, which had not sufficiently animalized the contained sea-water.†

The treatment, in all these cases, must be similar to that already advised as to poisonous fishes generally.

A case is reported of disease caused by eating a portion of the liver of the halibut, a fish quite common off the harbor of New York. The patient was seized with pain, nausea, vomiting, and headache; and shortly thereafter the skin began to exfoliate from his face and successively from every part of the body. In this condition he was admitted into the New York Hospital. The disease yielded to diaphoretics and the warm-bath.‡

The *Physalia* is a remarkable molluscous animal, inhabiting the tropical seas, and known to sailors under the name of the *Portuguese man-of-war*. Many scientific individuals speak of the pungent pain and irritation produced by handling them. Their tentacula twine round the hand or body, and the acrid exudation that issues produces the severe effects.§

* Horner's Medical and Topographical Observations upon the Mediterranean, etc., p. 66, in Bell's Select Medical Library and Eclectic Journal of Medicine. The crab, mackerel, oyster, herring, occasionally produces equally severe effects in the Netherlands. See Toxicographie de quelques poissons et crustacés de la mer du Nord, par M. Kesteloot; Bulletin de l'Académie Royale de Bruxelles, vol. viii. part 2, p. 302.

† London Med. Repository, vol. xiii. p. 58.

‡ Dr. A. C. Poist, New York Medical Journal, vol. i. p. 101.

§ See Bennet and Mayer, quoted in the London Quarterly Review, vol. lii. pp. 4 and 168; London Medical Gazette, vol. viii. p. 679; Abel's Journey to

As to the venomous nature of the *Toad*, various and contradictory opinions have existed; it is doubted at the present day, though formerly it was believed. King John of England is supposed to have been poisoned by a drink in which matter from a living toad had been infused. Pelletier has analyzed the venom of the common toad, and states it to consist of an acid, a very bitter and even caustic fat matter, and an animal matter having some analogy to gelatine.* Dr. John Davy considers it as a peculiar fluid secreted in the follicles of the skin, and states that it is extremely acrid when applied to the tongue, but innoxious to a chicken when inoculated with it.†

The *Pheasant* of this State and Pennsylvania (or *Partridge* as it is sometimes styled) is deemed poisonous during the winter and spring; and the cause assigned for it is its feeding on the buds of the laurel, (*Kalmia latifolia*,) which is one of the few shrubs which preserve their verdure throughout the cold season. The facts that we have on this subject are not numerous, but the impression is, notwithstanding, a general, and probably a safe one. Dr. Mease has published several cases, which occurred in 1791 and 1792, in Philadelphia, where individuals dining on pheasants only, were, in a few hours after, seized with giddiness, violent flushings of heat and cold, sickness at stomach, and repeated vomiting. These symptoms were soon succeeded by delirium, weak pulse, and extreme debility; while some cases were marked by the preservation of the senses, but a total inability to articulate. They were generally relieved by emetics, diluents, and mild stimulants. One case of death ensued, but there were so many causes combining, that it would be improper to ascribe it to the food alone.‡

China, p. 59. I have omitted a notice of the *Ornithorynchus paradoxus* in this edition, as we are now led to believe that its spur is not poisonous.

* London Medical Repository, vol. ix. p. 168. A case somewhat similar to the one mentioned in the text, is contained in Valentini's Pandects, vol. i. p. 554, "*De diarrhæa lethali a talpa (mole) potu ordinario injecta.*" The answer of the medical faculty of Giessen, discountenancing this idea, and attributing it to horror, is also given.

† Annals of Philosophy, N. S., vol. xi. pp. 137, 277; British and Foreign Medical Review, vol. xii. p. 136.

‡ Mease, in New York Medical Repository, vol. i. p. 153; Barton, in

In a case that occurred to Dr. Drake, also in the winter, vertigo, deadly sickness at the stomach, with extreme languor and exhaustion, suddenly attacked the patient. The pupils were dilated, no pulse was present in the arms or temple, and excruciating pain in the stomach, with a disposition to vomit, next supervened. An emetic somewhat relieved these, but tenesmus and griping remained for some time, and he very gradually recovered.*

In two other cases occurring in the same family, and where the symptoms were similar to the above, the place where the bird had been prepared for the spit was examined, and a number of the leaves of the laurel were found. This occurred in February, 1826.†

Additional cases are related by Dr. Hayward, of Boston, and Dr. Comstock, of Connecticut.‡

Poisonous honey. It has long been known that honey is occasionally poisonous. Many of the ancient writers contain facts on this subject; a number of the Greek soldiers, during the retreat of the ten thousand, are said to have been violently affected by some they had eaten near Trebisond.§ I will only

American Philosophical Transactions, vol. v. p. 60. The opinion has been long entertained that the food of animals may become poisonous from feeding on noxious substances. A number of authors are quoted to this effect, in Schlegel, vol. iii. p. 134; and among other remarks, it is stated that birds feeding on darnel have proved noxious.

* New York Medical Repository, vol. xxi. p. 460.

† Dr. Shoemaker, of Philadelphia, in North American Medical and Surgical Journal, vol. i. p. 321.

‡ Boston Medical and Surgical Journal, vol. xvi. pp. 123, 159. It is suggested, (ibid., p. 178,) that the poisonous quality is not owing to the food taken by the animal, but that a change *sui generis* is going on in the fluids, and consequently in the solids of the male at the season in question, from the beginning of February to the middle of March. I should, however, suppose that the cause assigned in the text is the most probable one.

Dr. Comstock quotes from the MS. Lectures of Dr. Rush, a statement that sixty boys were all taken sick in one night, from eating pot-pie made of wild pigeons which had fed on the berries of the *Phytolacca decandra*. (Ibid., vol. xvi. p. 317.)

§ On the knowledge of the ancients concerning poisonous honey, see Dr. B. S. Barton's paper, in the American Philosophical Transactions, vol. v. pp. 65 to 68; and Foderé, vol. iv. p. 290.

Mr. Keith E. Abbot, in a letter to the Zoological Society of London, dated

notice, at this time, the effects that have been produced in our own country, and their probable causes.

Dr. Barton, in the paper already noticed, states that a party of adventurers removed some hives of bees from Pennsylvania to New Jersey, in the hope that the savannas of the latter country might be favorable to the increase of these animals, and consequently to the making of honey. They accordingly placed them in the above situations, and where the kalmia was the principal flowering shrub. The bees increased prodigiously, and the enterprise appeared successful; but it was soon found that every one who ate of the honey became intoxicated to a high degree. It was then made into metheglin, but with a similar effect on those who partook of it.

The usual symptoms are dimness of sight, or vertigo, succeeded by a delirium which is sometimes mild and pleasant and sometimes ferocious, pain in the stomach and intestines, convulsions, profuse perspiration, foaming at the mouth, vomiting and purging, and in a few instances death. Sometimes vomiting is among the earliest symptoms, and in that case the patient is rapidly relieved, although a temporary weakness of the limbs is not an uncommon* result.*

Dr. Hosack has recorded two cases in which the substance produced violent vomiting, cold extremities, and a livid appearance of the countenance. The pulse was reduced to about twenty in a minute. The spontaneous vomiting, however, being followed by a dose of castor-oil, with fomentations, relieved the sufferers. In these instances the honey was of a dark-red-dish color, and a thicker consistence than is usually sold in the market.†

Trebisond, December 10, 1833, says that the bees are supposed to feed from the *Azalea pontica*; "that plant growing in abundance in this part of the country, and its blossoms emitting the most exquisite odor. The effect which it has on those who eat it is, as I have myself witnessed, precisely that which Xenophon describes. When taken in a small quantity, it causes violent headache and vomiting, and the unhappy individual who has swallowed it, resembles, as much as possible, a tipsy man; a larger dose will completely deprive him of all sense and power of moving for some hours afterwards." (London and Edinburgh Philosophical Magazine, vol. v. p. 314.)

* Barton, ut antea, vol. v. p. 52.

† Hosack's Medical and Philosophical Register, vol. iii. p. 390. Mr. A.

From the facts mentioned above, Dr. Barton is of opinion that the poisonous nature of the honey is owing to the bees feeding on venomous plants—as the various species of kalmia; the andromeda mariana, which is destructive to sheep; the rhododendron; the azalea nudiflora, and the datura. He recommends that every fetid or poisonous vegetable be removed from the neighborhood of the hives.

Besides the poisons now considered, there are others enumerated by systematic writers, which I defer noticing until I commence the investigation of MEDICAL POLICE. Of this description are *poisonous animals used as food*, as oxen, sheep, etc., in whom the fluids have been depraved by disease and *rabies*, (hydrophobia.) I shall conclude this division of the subject with a few remarks on the danger of *wounds received in dissection*.

The accidents to which anatomists are exposed in the prosecution of their studies are divided by Baron Percy into two classes: those resulting from the putrid gases extricated from the dead animal matters acting on the system generally; and those from inoculation of a septic principle in wounds. I propose noticing the second only.

The instances that are recorded are marked by a train of symptoms peculiarly malignant, and often suddenly fatal. Dr. Chambon pricked his middle finger with the sphenoid bone of a skull that had been long macerating. He was soon after seized with the most intolerable pain, and inflammatory swelling of the fingers and hand. At another time, from a similar cause, the mental faculties were disordered, the pulse was irregular, and extreme debility was present.

Corvisart, while examining a dead body, pricked his finger. The arm immediately swelled to an enormous size, and it was only by making repeated and deep incisions into the tumefied parts that Desault preserved his life.* Le Clerc, Professor of Legal Medicine in the School of Medicine at Paris, opened

De St. Hilaire found some poisonous honey in Brazil, which proved hurtful to himself and several of his party. (Edinburgh Philosophical Journal, vol. xiv. p. 91.

* Percy, New England Journal, vol. viii. pp. 193.

the body of an individual who had died of putrid fever. In dissecting he wounded his fingers. The virus immediately penetrated over the whole system, and he died on the third day after the accident. On examination, all the viscera were found in a putrid state.*

Cases have also occurred in England and in this country. Dr. Pett, of Clapton, assisted a medical friend in examining the body of a lady who died of peritoneal inflammation after child-birth. Twelve hours later, he complained of pain in the middle finger of his right hand, where a slight superficial wound was discovered. This was touched with caustic, and afterwards with strong sulphuric acid, but he did not feel either of the applications. A second application of lunar caustic produced intense pain. This was followed by severe rigor, and the pain spread with increasing agony along the arm. He passed a sleepless night, and in the morning his finger was white and without sensation, and his countenance alarmingly altered. The arm went on to swell, the superficial absorbents appeared inflamed, the pectoral and axillary region became much affected, the finger put on the appearance of gangrene, and there was high nervous excitement generally. The unfavorable symptoms rapidly increased, and notwithstanding every means that was used, he sunk in one hundred and five hours after the injury. On examination, the chest and abdomen were found healthy, the heart rather large and flabby, and the liver considerably deranged by a chronic affection.†

A valued friend and colleague of mine, some years since, nearly lost his life from a similar cause. He punctured his finger with a needle while examining the body of a child. In forty-eight hours afterwards, acute, lancinating pains were felt in the wound, and it assumed a deep purple color. The arm itself, and the glands of the axilla, also became affected, and were exquisitely painful. A general disturbance of the nervous system soon succeeded, and he was only relieved by strict adherence to the antiphlogistic treatment.

* New York Medical Repository, vol. xi. p. 433.

† Quarterly Journal of Foreign Medicine and Surgery, vol. v. p. 313.

These cases are sufficient to show the danger that sometimes follows from a puncture during dissection. Whether this danger is aggravated by a peculiar condition of the system, is in some degree still undetermined; but it is not improbable that the effects may be exacerbated in cases where there is a previous predisposition to disease, either of a temporary or constitutional nature.

This subject, however, has been treated in a very elaborate manner by the late Dr. Duncan, Jun., in his paper on Diffuse Inflammation of the Cellular Tissue; and to it and the authorities quoted below, I must refer the reader.*

As to the treatment, but little needs be said. Chaussier recommends that every student should keep constantly in his pocket a small phial of muriate of antimony, and whenever he wounds himself, immediately cauterize the puncture with it. Percy advises the application of strong nitric acid.

The disease of the system can only be combated by the same remedies that are generally applicable in cases where the nervous and cellular systems are severely affected.†

* Duncan, Edinburgh Medico-Chirurgical Transactions, vol. i. pp. 455 to 650; Sir Astley Cooper's Lectures; Shaw's Manual of Anatomy, vol. i., Introduction; Godman, Chapman's Journal, vol. ix. p. 359; Dr. Colles, in Dublin Hospital Reports, vol. iii. and iv.; Edinburgh Medical and Surgical Journal, vol. xxiv. pp. 56, 59, 225, vol. xxvi. pp. 86, 105; Travers on Constitutional Irritation; Copland's Dictionary, art. *Cellular Tissue*; Lawrence on Dissection Wounds, Lancet, N. S., vol. v. p. 561; Dr. Milledoller, on the Poison of Putrid Animal Matter, New York Medical and Physical Journal, vol. ix. p. 39. Mr. Stafford, Medico-Chirurgical Transactions, vol. xx., advises the free application of nitrate of silver, leeches, and muriate of morphia, to allay irritation, and particularly insists on early incisions. Mayo, in London Medical Gazette, vol. xxix. p. 463; Harden, in American Journal of Medical Sciences, vol. xxii. p. 396; Hayward, in *ibid.*, N. S., vol. vii. p. 64; Benson, Medico-Chirurgical Review, vol. xxvii. p. 445; Dr. Craigie, on Inflammation of the Adipose Tissue, Edinburgh Medical and Surgical Journal, vol. xlviii. p. 396; Dr. Macartney, Medico-Chirurgical Review, vol. xxxiv. p. 133.

† New England Journal, vol. viii. p. 195. There is a very curious fact recorded by Professor Silliman, in his Journal, vol. ii. p. 168, on the authority of Dr. Samuel Brown. Dr. B. informed him that he had had patients under his care who had been bitten in personal combats, and whose wounds exhibited every symptom of poison, pertinaciously resisting all the ordinary modes of cure. The saliva and tartar of the teeth are mentioned as probably the

5. MECHANICAL IRRITANTS.

There is one substance that requires to be noticed, principally for the purpose of establishing its *innocuous* properties. If it deserves a place in a treatise on toxicology, it must be, as Professor Christison has very properly styled it, as a *mechanical irritant*.

Glass and enamel in powder. This was formerly deemed a highly poisonous substance. It was one of the articles administered to Sir Thomas Overbury for his destruction, and toxicologists and medical jurists, even to the present day, continue its arrangement with the corrosive poisons. Various experimenters have, however, given it in considerable quantity to animals, and even to men, without producing any injury. Le Sauvage administered several drachms to cats, dogs, and rats, and in neither, during life, was any illness perceived, nor on being killed for the purpose of dissection, was any lesion noticed in the stomach or intestines. Caldani and Mandruzatto are also said to have made similar experiments on animals, and the latter on himself, with the same results.* It would thus seem that the substance in question can hardly be deemed a poison, at least in the ordinary sense of the term. But there is no doubt that it may produce injury by its insolubility and its

deleterious substances in these cases. Other cases are mentioned in the Annals of Medicine, and in the Atlas, (London newspaper,) August 19, 1848, and an analogous instance excited some attention in this country in 1841. A gentleman, more than eighty years old, died of hepatic disease, and at its termination was affected with a severe thrush in the mouth, accompanied by frequent hemorrhage. The son was in good health, except a sore on his lips. He shaved the corpse, and without waiting to wipe the razor, and using the same lather and brush, also shaved himself. His face soon became swollen, the sore increased in size, and after a most hideous swelling of the head, with great pain, he died, ten days subsequent to the shaving. This case occurred at Farmingham, Massachusetts. (Boston Medical and Surgical Journal, vol. xxv. p. 197. Dr. Meas, in American Medical Intelligencer, N. S., vol. i. p. 154.)

* Orfila, vol. i. p. 418; Marc, p. 61. Le Sauvage also made numerous experiments on himself with pounded glass, but no inconvenience or injury was produced. (See New York Medical Repository, vol. xiv. p. 406, for a statement of his experiments.)

mechanical properties. If the fragments be coarse or large inflammation may arise from the irritation that is excited.

Mr. Hebb relates a case of this kind. A child, eleven months old, died under suspicious circumstances, and the coroner requested him to make an examination. He found the inside of the stomach lined with a tough layer of mucus, streaked with blood, while the villous coat was highly vascular, and covered with numberless particles of glass of various sizes, some of which touched, while others lacerated it. None of it was found beyond the pylorus, and the rest of the body was healthy. Mr. Hebb is of opinion that it was given mixed with sugar. Although indicted, the supposed murderers escaped, under the idea that the glass might have been accidentally ground and mixed with the sugar.*

There is a remarkable case on record, where a husband was accused of having poisoned his wife by means of this substance.

Louis Lavalley, a young man residing near Bayeux, in France, became attached to Maria Guerin, the daughter of a neighbor. After the intimacy had continued for some time, it was discovered that she was pregnant, and her relatives urged the necessity of marriage. As Louis continued deeply enamored of the female, but little difficulty was experienced in effecting this, and his parents readily consented to the union. They were married on the 5th of November, 1807, but were to remain separate, at the request of the family of Guerin, until after her delivery.†

On the 13th of December, Lavalley invited his wife and father-in-law to a family dinner. The entertainment consisted of roast pig, black pudding, and calf's liver; and the

* Midland Medical and Surgical Reporter, vol. i. p. 47.

† It is intimated, as a reason for this, that she labored under a "maladie dartreuse," for which she was under treatment, and which they desired to conceal.

A case occurred in 1845, in France, where an unnatural father and step-mother attempted to poison the son, aged three years, with powdered glass mixed in a paste. They were condemned to ten years imprisonment. (*Gazette des Tribunaux*, February 6, 1845.) For other cases, and comments on them, see *ibid.*, March 12, and April 25, 1846.

bride partook freely of all of them. To these coffee succeeded, and she mixed a little brandy with hers. She was urged to remain that evening, but her father opposed it, and she returned to his home with him. She continued well during the night, but early on the next morning was seized with violent pains, and in four or five hours convulsions followed. Medical aid was afforded, but without relief. Delivery with instruments was then attempted, but an alarming hemorrhage obliged the accoucheur to abandon it, and finally, as death seemed inevitable, the infant was extracted by the Cæsarean operation. She died during this, and her infant did not survive her. The funeral took place as usual; but about a month after her decease, and when some disagreement had taken place among the families, concerning the disposition of her marriage settlement, a report came into circulation that she had been poisoned, and the husband was named as the murderer. The body was disinterred forty-two days after death, and although putrefaction was greatly advanced, yet the stomach and other viscera were removed and carried away for examination.

The reports made concerning the dissection were as follows: The stomach, duodenum, ileum, and rectum, on being opened, exhibited numerous black points and spots. On the internal coat of the intestines a whitish substance was discovered, which was ascertained by the magnifying glass and chemical experiments to be *pounded glass*. Vesicles, resembling the effects of a burn, were also present, and particularly in those places where the black spots were most numerous; and some slight erosion was observed. On these grounds the surgeons and chemists gave it as their opinion that the pounded glass had produced the symptoms and the fatal termination.

Lavalley was dragged to prison, with every mark of opprobrium. His advocate, however, addressed several questions to the President of the School of Medicine, for the purpose of elucidating the medical testimony. And these were answered by two of the professors, whose names are well known throughout the medical world, Baudelocque and Chaussier. Their report is dated March, 1808. After stating the questions put to them, I shall detail the substance of their answers.

The first interrogatory was, whether, from the facts stated above, there appeared to be any natural causes for the death of the female, either as regards her situation, the food she had taken, the medical assistance she had received, or the omission of proper remedies?

To this it is replied, that the nature of the food taken by the female being rather indigestible, the addition of brandy to her coffee, and her subsequent walk, might have aided in producing indigestion; that this is a common occurrence from any impropriety in eating, with females advanced in pregnancy, and that convulsions are in these cases a common consequence of indigestion. As to the treatment, they decline any observations, but intimate an opinion that the attempted delivery with instruments, when no dilatation was present, as well as the Cæsarean operation, were both improper.

The second question was, whether her death ought to be attributed to the pounded glass found in the stomach and intestines; whether this glass is a poison, and if so, what are its effects and mode of operation, and do these correspond to the appearances observed on dissection?

The professors intimate a doubt whether the substance found was actually glass, but admitting it was so, they proceeded to examine its nature. They observe that it is a common and ancient opinion that rock crystal, the diamond, glass, and other analogous substances, are active and dangerous poisons, since, by their hardness, they tear and pierce the coats of the intestines. This belief, however, is shown to be totally incorrect by numerous quotations from various authors, of persons who had swallowed diamonds, and of eaters of glass, in large pieces, all of whom had escaped injury. They declare that glass, in a state of fine powder, is an inert substance, and particularly so when the stomach is filled with food. The idea of its being taken in the coffee is at once refuted by the fact that it would fall to the bottom by its own gravity; and it is suggested whether, if glass were actually present in the intestines, it might not have come from some vessel which she had broken with her teeth during the existence of the convulsions.

The last question was, whether putrefaction would not produce great changes in a body forty-two days after death; and

if so, what caused the state of the viscera, as reported by the examiners?

It is replied, that usually the term of forty days produces such a change as to render an examination altogether uncertain, but even allowing the season to have been favorable for the preservation of the body, they do not conceive the facts stated to indicate the results of poison. Convulsions supervening on a full stomach, and passing to a fatal termination, would leave an engorged state of the vessels in various parts, and predispose to ecchymosis, while the progress of putrefaction would readily explain the black spots that were observed. The medicines administered, being antimonial emetics and an enema of senna, must also, and particularly as they proved inefficacious, have aided in determining the irritation to the stomach and bowels. As to the erosions, they remark that their appearance proves little, since they are frequently observed in those who die from diseases which exclude all idea of poison.

The professors conclude with observing that, as natural causes will abundantly account for the death of the female, they consider the accused husband as guiltless; and when brought to trial before the criminal court of Caen, he was acquitted by the *unanimous* verdict of the jury.*

Introduction of pins and needles into the digestive organs. I notice this here, for want of a better place, in consequence of a late trial in France. A servant-girl, aged seventeen, was indicted for attempting to kill a child, aged two months and a half, by making it swallow ten pins. It was in fine health, when it was suddenly attacked with dyspnœa and fits of suffo-

* Causes Célèbres par Mejan, vol. ii. p. 324; vol. iii. p. 344. Marc, in a recent case where he was consulted, gave an opinion corresponding to the above. The case is mentioned in detail in Annales d'Hygiène, vol. iii. p. 365. A negro woman in the Island of Jamaica attempted to poison a whole family with pounded glass, which was put into a dish of curried fish. The fact was discovered toward the end of the meal, and the master of the family gave purgatives to each; in consequence of which they all passed large quantities of coarsely-powdered bottle-glass. When Dr. Turner, who reports the case, saw them, four days after the attempt, they had not suffered any inconvenience. (Edinburgh Medical and Surgical Journal, vol. xxii. p. 224.)

cation, which continued for several days, and appeared to threaten its life. After this it recovered its health. The cause remained unknown until the next day, when the mother found three pins in the child's stool, four more in the evening, and three the next morning. Dr. Ollivier, of Angers, examined the criminal in prison, and his testimony inclining to a belief in her insanity, she was acquitted. The child remained well.

From having been consulted in this case, Dr. Ollivier was led to examine into the published cases where pins and needles have been swallowed, with the view of ascertaining the amount of danger likely to result from their introduction into the digestive organs. In a majority of instances they appear not to have caused any appreciable inconvenience or injury, but in others the symptoms have been more or less alarming, depending on whether the pin has penetrated the coats of the pharynx or œsophagus, or transfixed the cartilages of the larynx or trachea, or the coats of the stomach. A fatal case from swallowing a needle is quoted from M. Guersant. The child died, after incessant vomiting and much suffering, in two months; and on examination, the needle was found at a little distance from the pylorus, traversing the coats of the stomach, and fixed pretty deeply in the substance of the liver. No inflammation, however, existed round this foreign body. Instances are also not uncommon of pins and needles being discharged at various parts of the surface, and Dupuytren relates of a maniac who died from numerous abscesses thus formed. Many, however, have escaped all serious consequences.

The inference, then, from a review of these cases, is, that although they have generally ended favorably, yet we are never sure that a future one will result thus: "there are examples both of recovery and of death."*

* *Annales d'Hygiène*, vol. xxi. p. 178; *Edinburgh Medical and Surgical Journal*, vol. li. p. 559; *London Medical Gazette*, vol. xxiii. pp. 767, 799.

6. IRRITANT GASES.

Chlorine in a gaseous state destroys those who breathe it, by producing great irritation of the bronchiæ, and when even diluted with atmospheric air, it causes cough and inflammation. Pelletier is thus said to have fallen a victim to its effects.

Nysten and Orfila have performed several experiments with gaseous chlorine on animals. When injected into the jugular it caused pain, difficult breathing, and speedy death; and the blood, on examination, was dark colored and altogether fluid. The injection of it into the pleura excited great agitation, extreme pain, and trembling of the limbs; but the animal survived the immediate effects. On the third day he was killed, and the pleura was found covered with a false membrane, and bore all the appearances of recent inflammation.*

Mr. Broughton found that animals put in this gas died in less than thirty seconds. The lungs were tinged with the yellow color of the gas, and the peculiar odor of chlorine was perceptible throughout their structure.†

The power of habit, however, is remarkable, in accustoming the system to the effects of this substance. In many of the manufactories in Great Britain, where the workmen constantly breathe an atmosphere of chlorine, but little injury is experienced, except acidity and other stomach complaints, and for this they use chalk. Many aged men are found in these establishments.‡

Fluid chlorine, when introduced into the stomach, caused dejection and death; and on dissection, the mucous membrane of the stomach was either extensively inflamed or ulcerated. The other organs were unaffected. It is hence evident that its action resembles that of the stronger acids.

Antidotes. The inhalation of ammonia or of sulphuric ether, or, if nothing else be accessible, inhaling warm water from a teapot or other vessel. A mixture of albumen and water has

* Orfila's Toxicology, vol. ii. p. 92.

† Brand's Journal, N. S., vol. ii. p. 15.

‡ Christison, p. 697.

been recommended by Devergie. For this purpose the whites of eggs may be mixed with water. If not at hand, milk should be given.* When inflammation is induced, it requires active treatment.

Nitrous acid vapor. Dr. Desgranges has presented a valuable case, illustrative of the effects of this substance on the animal economy:—

A merchant at Lyons, aged forty-five, and of a tolerably strong constitution, had stored a considerable quantity of nitrous acid in his warehouse. He was awakened one morning by the howling of the watch dog, which he had shut up in it; and on opening the door, immediately perceived the smell of nitrous gas. The dog rushed out with his paws burnt, ran to the nearest water to quench his thirst, and after playing an hour or two with some other dogs, returned and expired at his master's door, after vomiting thick matter of various colors.

The merchant attempted to enter the warehouse, but was driven back in a few minutes by the approach of suffocation. He, however, persisted in again visiting the room, and finally succeeded in carrying out the broken canteens. Two were found empty, each of which had contained thirty-two pounds of aquafortis.

This was early in the morning. At six o'clock he breakfasted, and then went to pay a visit, but returned before eight with a dry, burning heat in the throat, irritation in the stomach and breast, and a very painful sense of tightness near the attachment of the diaphragm. He was advised to drink freely of milk, and fomentations were applied to the abdomen, together with sinapisms to the arms. The two last remedies seemed to fatigue him much, and to augment his distress, but he continued the milk. At one o'clock, he felt easier—had a spontaneous yellow stool, and in the space of an hour or two others, both of the color of citrine ointment. His urine was scanty, and in the evening he experienced frequent pressing desire to make water, but always in vain. At four o'clock he

* Pereira. (London Medical Gazette, vol. xvii. p. 709.) Breathing the vapor of alcohol, and swallowing pieces of sugar steeped in it, have also been found very useful.

began to expectorate a yellowish matter, and had afterwards a little cough and slight vomiting. Injections were given him, which came off instantly, but colored yellow. At nine, his body became of a blue color; his breathing was oppressed; there was some rattling in the throat, and hiccough; and he complained of great pain in the abdomen and across the bottom of the thorax; convulsive motions and slight delirium also supervened. Toward morning his anguish increased, and his anxiety became inexpressible. He, however, preserved his senses until six, and died at seven o'clock. Shortly after death, his belly swelled, and became distended in a remarkable manner; his face was purple, his lips black, and some blood issued from his nose and mouth. The body was not opened.*

There is also a curious case related in the Philosophical Transactions by Dr. Mounsey, where a long train of symptoms afflicted an individual at Moscow, apparently from inhaling the fumes of a mixture of verdigris and false gold-leaf with nitric acid. Red spots appeared on various parts of his body; nausea, pain, and anxiety at the pit of the stomach came on; and it was not until after several days that he was relieved from the pains in various parts of his body.†

Muriatic acid gas, (hydrochloric acid gas.) Drs. Christison and Turner found this extremely destructive to vegetables; and not long since a soap manufactory was adjudged a nuisance in England in consequence of its being proved that the gas issuing from it destroyed vegetation, and affected men and animals passing near it. Animals died in convulsions from breathing it.‡

Sulphurous acid gas. This is constantly disengaged when sulphur is burnt in the open air. It is also produced by the roasting of various metals.

In March, 1817, a number of miners at the Lead-hills in

* Edinburgh Medical and Surgical Journal, vol. iii. p. 16.

† Philosophical Transactions, vol. l. p. 19; vol. liv. p. 15. Another fatal case is given by Dr. Cherrier, (Bulletin de la Société d'Emulation,) London Medical Repository, vol. xxi. p. 440. Death followed in two days, and inflammation of the lungs was discovered.

‡ London Medical Gazette, vol. x. pp. 311, 350.

Scotland, who had gone down to work at the depth of twenty-five fathoms, were suddenly seized with difficulty of breathing, violent pain in the head, weakness of the lower extremities, palpitation, and in some cases vomiting. Giddiness ensued, and in a short time complete mania. Some were furious, and others listless, or appeared as if they were intoxicated. Vomiting or retching generally came on when they had been exposed for some time to the air above ground; and in other cases tenesmus was present. By the use of emetics or purgatives, as the symptoms indicated, they were relieved, and recovered in the course of a few days. Two, however, who could not be brought up, died.

The accident, in this instance, was attributed to a quantity of smoke escaping from the chimney of the engine under ground, into the way-gates, and so contaminating the air in the workings, from the sulphurous acid gas which it contained. It evidently was but slightly charged with carbonic acid gas, since the candles burnt, though faintly, at the place where the men perished.*

In the following instance, I also apprehend that sulphurous acid gas was the main cause of death.

In November, 1821, a smith at Maidstone was repairing the inside of the boiler of a steam-engine; and in joining two pieces of iron he made use of a cement composed of sal ammoniac, sulphur, and iron turnings, which produced such a quantity of fumes that he was suffocated in a few moments. His assistant being at work on the outside, and hearing a struggling noise within, got through the opening at the top of the boiler, and while descending to his master's assistance, inhaled the fumes and fell to the bottom. A workman attempted twice to descend to his assistance, but he was so powerfully affected by the effluvia that he was obliged to desist.

* Edinburgh Medical and Surgical Journal, vol. xiii. p. 353; case by Mr. Braid, surgeon. Water, on being thrown down the shaft, improved the air so much, probably by absorbing the sulphurous acid gas, that one person, who had lain insensible for an hour at the side of the shaft, was restored. See also Mr. Watson's cases, *ibid.*, vol. xxxii. p. 345; and Mr. Bald, on the fires that take place in collieries, Edinburgh New Philosophical Journal, vol. v. p. 103.

A large quantity of water having been thrown into the boiler, the bodies were brought out. The master was quite dead, and his assistant, though he exhibited some signs of life when taken out, died next morning.*

Seleniuretted hydrogen. From the experiments of Berzelius, this gas would seem to be highly deleterious. On smelling a small bubble not larger than a pea, its effect on the olfactory organ was so powerful that he lost the power of distinguishing caustic ammonia, although he held a bottle of it to his nose. On another occasion, inflammation of the eyes and nose, cough and expectoration, and indeed all the symptoms of violent catarrh occurred, nor were they relieved until a blister was applied to the chest.†

* Edinburgh Philosophical Journal, vol. vi. p. 402, from the Technical Repository.

† Berzelius, *Traité de Chimie*, vol. ii. p. 414. It has been suggested that the very deleterious qualities ascribed to sulphuretted hydrogen by the French chemists may have been owing to an admixture of selenium with the sulphur. (*Annals of Philosophy*, N. S., vol. viii. p. 230.)

CHAPTER XX.

NARCOTIC POISONS.

OPIMUM: its constituents—*morphine*—*narcotine*—*codeine*—*paramorphine*. Symptoms and effects of opium and laudanum; ordinary duration of a fatal case; quantity that can produce death. Effects of habit; opium eating; whether this is compatible with longevity. Effects of opium in the form of injection, or when applied externally; effects on animals. Symptoms and effects of *morphine*—cases; of *narcotine*; of *meconic acid*; of *codeine*—of *paramorphine*. Appearances on dissection, from taking opium and laudanum. Chemical proofs. Tests of *meconic acid*; of *morphine* and its salts; of opium in solution; of opium in mixed fluids and solids. Inability always to find indications of opium. Case of Castaing. Treatment. *Hyoscyamus niger* and *albus*. *Solanum dulcamara*. *Lactuca virosa*. *Taxus baccata*. *Paris quadrifolia*. *Actæa spicata*. PRUSSIC ACID. Symptoms; quantity that can produce death; time in which its effects are completed. Appearances on dissection. Effects on animals. Tests—in the pure state; when mixed with animal matters. Antidotes. Hydrocyanates. Hydrocyanic ether. Cyanides of iodine—of bromine—of potassium. *Prunus lauro-cerasus*—*laurel-water*—effects—case of Sir Theodosius Boughton. *Prunus padus*. *Prunus virginiana*. *Prunus nigra*. *Prunus caroliniana*. *Amygdalus communis*—oil of bitter almonds. *Amygdalus persica*. *Sorbus aucuparia*. CARBAZOTIC ACID. NARCOTIC GASES. Nitrogen—carbonic oxide—carburetted hydrogen—nitrous oxide—cyanogen—oxygen—hydrogen.

NARCOTIC poisons are defined by Orfila to be those which produce stupor, drowsiness, paralysis, or apoplexy and convulsions. "The term *narcotism*," says Dr. Christison, "has been used by different writers with different significations, but it is now generally understood to denote the effects of such poisons as bring on a state of the system like that caused by apoplexy, epilepsy, or other disorders commonly called nervous. Narcotic poisons, therefore, are such as produce chiefly or solely, symptoms of a disorder of the nervous system."

In a previous chapter I mentioned the effects generally,
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and the appearances on dissection, that most commonly accompany this class. The peculiarities of each section will now be noticed.

Under this division, the following substances are commonly arranged:—

VEGETABLE NARCOTICS.	<i>Smilacæ.</i>	PRUSSIC ACID, and its various compounds, etc.
<i>Papaveracæ.</i>	Paris.	CARBAZOTIC ACID.
Papaver,	<i>Ranunculacæ.</i>	NARCOTIC GASES.
Morphine.	Actæa.	Nitrogen,
Narcotine.	<i>Rutacæ.</i>	Carbonic oxide,
<i>Solanæ.</i>	Peganum.	Carburetted hydrogen,
Hyoscyamus,	<i>Ericæ.</i>	Nitrous oxide,
Solanum,	Azalea.	Cyanogen gas,
Physalis.	<i>Amygdalæ.</i>	Oxygen gas,
<i>Compositæ.</i>	Prunus and Cerasus,	Hydrogen,
Lactuca.	Amygdalus and Persica.	Sulphuretted hydrogen,*
<i>Coniferæ.</i>	<i>Pomacæ.</i>	Carbonic acid gas.*
Taxus.	Sorbus.	

OPIUM.

This substance is the inspissated juice of the *Papaver somniferum*, or common white poppy, obtained by incision into its capsules when they have arrived at a certain state of maturity. Its appearance and character are so well known that it is not necessary to enlarge upon them; but it must be mentioned that, within the present century, it has been ascertained to be a very compound substance. For our knowledge of it, we are indebted to Derosné, Sertuerner, Robiquet, Magendie, and several other French chemists.

By various manipulations, there have been obtained from opium, *morphine*, *narcotine*, a peculiar acid, termed the *meconic*, and a *resinoid substance*. To these, of late, are added the *codeine* of Robiquet, the *narceine* and *paramorphine* (thebaine of Couerbe) of Pelletier, the *meconine* of Dublanc and Couerbe, and various other ingredients.†

* Already noticed.

† Johnson's Report on Chemistry, Proceedings of British Association, 1832, p. 513; Philosophical Magazine and Annals, vol. xi. p. 395; London and Edinburgh Philosophical Magazine, vol. ii. pp. 153, 156. An analysis of

From the circumstance that opium contains so many distinct principles, and that two or more of these may unite in producing its ordinary effects, while some of them separately have been used as instruments of poison, it becomes somewhat difficult to present this subject distinctly to the reader. I can, however, devise no better mode than to treat of the symptoms and effects on animals, the appearances on dissection, and the chemical proofs, successively, and notice under each head, first opium and laudanum, and next, the various principles contained in them.

Symptoms and effects of opium. When opium or laudanum is taken in large quantities, the following symptoms are usually observed within a short time: Giddiness, insensibility, and immobility, respiration scarcely perceptible, and a small and feeble pulse, which sometimes becomes full and slow. The eyes are shut, the pupils contracted, and the whole expression of the countenance is usually that of deep and perfect repose. As the effects increase, the lethargic state becomes more profound, deglutition is suspended, the breathing is occasionally stertorous, the pupils insensible, the countenance pale and cadaverous, and the muscles of the limbs and trunk in a state of relaxation. Vomiting sometimes supervenes, and there is an occasional glimpse of returning animation, but the comatose state soon returns, and death (in some cases preceded by convulsions) follows. [A person may die from opium without being necessarily narcotized up to the time of death.]*

The period which elapses between taking the poison and the commencement of the symptoms is various. The tincture of

Pelletier's paper, (from *Journal de Pharmacie* of November, 1832,) in *Lancet*, N. S., vol. xi. p. 334.

A subsequent memoir, by the same author, entitled *New Researches on Opium and its Principles*, read August, 1835, in *Journal de Pharmacie*, vol. xxi. p. 555.

Pelletier has also announced another principle, occasionally found by him in opium, and which he terms *pseudomorphine*.

Merck is said to have discovered still another, called *porphyroxin*. (*British Annals of Medicine*, vol. ii. p. 82; *Pharmaceutical Transactions*, vol. iii. p. 122.) And Liebig and Wohler, *Opianic acid*. (London, Edinburgh, and Dublin *Philosophical Magazine*, vol. xxii. p. 449.)

* Taylor on Poisons, p. 522.

opium (laudanum) in large quantities, and on an empty stomach, may probably begin to act in a few minutes. From a comparison of cases by Dr. Christison, it would appear that several individuals were found soporose, in a quarter of an hour. When swallowed in the solid form, the action of opium is usually delayed for an hour. It may operate before that time, but the interval is seldom extended.

When noticing the diseases that might be confounded with narcotic poisoning, I mentioned the distinction between the coma produced by apoplexy and by opium. In the latter case, unless the fatal termination is near, the individual may be roused by brisk agitation, tickling the nostrils, or loud speaking. This state of restored consciousness is, however, always imperfect, and is speedily followed by lethargy when the exciting cause is withheld.*

Although convulsions and spasms are not common, yet when they do occur, they are usually extremely severe. It is probable that, in some instances, the use of remedies may aid in causing them.

There are varieties noticed, as to the state and frequency of the pulse, the appearance of the pupils, and the expression of the countenance.†

The bladder sometimes does not contract on its contents,

* Christison, p. 619. If solid opium has been swallowed, stupor commonly commences from half an hour to an hour. In a case, however, by Desruelles, where two drachms of solid opium had been taken, the stupor was complete in fifteen minutes; and, on the other hand, in the case where the largest quantity was swallowed which has been recorded, (American Medical Recorder, vol. xiii.,) viz., eight drachms of crude opium, the patient was able, an hour afterwards, to tell her physician, connectedly, what she had done.

Sleep seems to retard the operation of opium, provided it occurs immediately after taking it. There are several instances on record of this description. In one that occurred to Dr. Skae, half an ounce of laudanum was taken, the individual slept for an hour, and then arose from bed and procured a drink for himself; and yet in about ten hours afterwards he died, with all the symptoms of narcotic poisoning. (Dr. Skae on the varieties observed in the symptoms of poisoning with opium, Edinburgh Monthly Journal, vol. i. p. 69.)

† Orfila has shown that *contraction* of the pupils is most common in the early stages. The difference of opinion between him and Chaussier, on this point, will be noticed in the details of the trial of Castaing.

and attempts to empty it prove useless.* While, again, in cases of recovery, a weakness will be left in the lower extremities, approaching to paralysis, and the bladder does not always retain its contents.† The secretion itself is generally diminished.

Two instances are mentioned in which vomiting was *the sole effect* induced from taking large quantities of opium. In one case, an ounce of laudanum was swallowed at midnight, the individual went to sleep, and shortly after rising, began to vomit, and continued so during the day. The next day he was well. In the other, three ounces produced, in a few hours, a similar result.‡

Constipation of the bowels is the usual result of opium taken in large quantities; yet, in one or two cases, it has produced colic or diarrhoea.

According to Dr. Christison, the ordinary duration of a fatal case of poisoning with opium is from seven to twelve hours. There is, of course, variation in this; but the majority of instances come within the period stated.§ The dose requisite to

* See case by Mr. Cornish, London Medical and Physical Journal, vol. xxxi. p. 193; and also a case, *ibid.*, vol. xxviii. p. 80.

† An instance of this kind, by Mr. Murley, is quoted in the Eclectic Repository, from the London Medical Review for October, 1811.

‡ London Medical Repository, vol. ix. p. 525; vol. x. p. 175. Dr. Christison mentions some additional cases. [They are quite common.—G.]

§ The extremes mentioned by him, are, a case from the London Medical and Physical Journal, vol. xxxi., which proved fatal in three hours, and another which occurred to Alibert, in twenty-four hours. (Christison, p. 623.)

In a case tried before the Court of King's Bench, in 1832, (*Kinnear v. Borradaile*), where an insurance company contested the payment on the ground of the probability of narcotic poisoning, the servant positively swore that he heard the room-bell ring at 9 A. M., and was further certain that no one but the individual in question could have rung it. He was found dead at 11 A. M. The countenance was pale, the trunk warm, but the extremities were cold. The vessels of the brain were rather full, and blood, to the amount of three pints, was found in the stomach. There was no smell of laudanum, nor any marks of vomiting. This individual went to bed late on the preceding evening in his usual health. The jury found for the plaintiff, and thus negatived the idea of poisoning. (*Lancet*, N. S., vol. x. p. 468.)

A soldier in the 29th Regiment, stationed in Edinburgh Castle, took two and a half ounces of the *liquor opii sedativus*, twenty minutes before 9 P. M. He was seen a quarter of an hour thereafter, by Dr. Cooper, the surgeon, who

cause death must necessarily be more a matter of uncertainty. From thirty to sixty grains have, in many instances, produced it; and Dr. Christison mentions a case which was furnished to him by Dr. W. Brown, of Edinburgh, in which even so small a quantity as "four grains and a half, taken by an adult, along with nine grains of camphor, was followed by the usual signs of narcotism, and death in nine hours. The man took the opium for a cough, at seven in the morning; at nine, his wife found him in a deep sleep, from which she could not rouse him; nothing was done for his relief till 3 P. M., when Dr. Brown was called to him, and found him laboring under all the usual symptoms of poisoning with opium, contracted pupils among the rest, and death ensued in an hour, notwithstanding the active employment of remedies. On examining the body, no morbid appearance of any note was found, except fluidity of the blood.*

found him totally *insensible*. The face was purple, and the features distorted, the pupils *dilated* and insensible, the breathing stertorous, and accompanied with hiccough, and the pulse slow and small. The stomach was emptied and washed out by means of the stomach-pump, and the other remedies usual in such cases were adopted; but the man expired at 10 P. M., *an hour and twenty minutes* after swallowing the poison. (Dr. Skae, as before.)

Mr. Taylor mentions a French case of a soldier who swallowed, by mistake, an ounce of laudanum, and died in convulsions in *three-quarters of an hour*.

* Christison, p. 624. On infants, extremely small quantities sometimes cause fatal effects. Dr. Kelso relates a case, (*Lancet*, N. S., vol. xxi. p. 304,) where four drops of laudanum, given to a child nine months old, were probably the cause of its death.

There is no doubt that fatal effects frequently result from the too free use of empirical preparations of opium. In the returns made by the coroners of England and Wales to the House of Commons, in 1839, ten cases of death from Godfrey's cordial are stated. Dr. John Clarke mentions an infant destroyed by forty drops of Dalby's Carminative. (*London Medical Gazette*, vol. xxxi. p. 270.) An anonymous writer, (*ibid.*, vol. xxxiii. p. 877,) on the authority of Dr. Paris, denies that this last contains opium. The receipt given in the first reference proves the contrary.

Twelve drops of Battley's sedative solution, given at bedtime to a feeble woman, aged fifty-five, proved fatal; she never woke again. (*Toogood, Provincial Med. and Surg. Journal*, November 18, 1841.)

To a child five and a half years old, a mixture containing half its amount of paregoric elixir, was given in doses of teaspoonsful every four hours. Five or six doses were given, and the child died in thirty-seven hours from the administration of the first dose. "One grain and a quarter of opium,

The effects of habit, however, render the system for a time insensible to large and repeated doses; and in this way only can we explain why enormous quantities are daily taken by individuals without any of the symptoms of poisoning, as now stated.

That injurious consequences finally occur, would appear to be established by the concurrent testimony of travellers in the East. The Turks, as is well known, are, of all nations, the most generally attached to its use; and the following description of the *Teriakis*, or opium-eaters of Constantinople, fully explains the result. "Pale, emaciated, and rickety, sunk into a profound stupor, or agitated by the grimaces of delirium, their persons are, after the first view, easily to be recognized, and make an impression too deep to be speedily erased. The increasing attachment for wine has diminished the consumption of opium, but there are still Teriakis who will swallow in a glass of water, three or four lozenges, amounting to one hundred grains."*

Mr. Madden, a recent medical traveller, fully confirms this account, and he adds that a regular opium-eater seldom lives beyond thirty years, if he commences the practice early.† This will be found, I apprehend, most conformable to the result of ordinary experience.

divided in five doses, over a space of thirty hours, caused death." (Guy's Hospital Reports, second series, vol. ii. p. 32, by A. S. Taylor.)

The dangerous effects of opium on the infant subject are strongly illustrated, both by facts and arguments, in a paper by Dr. Jno. B. Beck, in the New York Journal of Medicine, vol. ii. p. vii., and subsequently in his work on Infant Therapeutics. Ten grains of Dover's powders, (containing one grain of opium,) given by mistake to an infant seven weeks old, caused death in twenty-four hours. (Griffith's, in London Med. Gazette, vol. xxxiii. p. 772.) A case mentioned in the Medical Times, vol. x. p. 438, where two drops of laudanum, given four times during eighteen hours, in a mixture, proved fatal to a child six weeks old. The decoction of poppies, and syrup of poppies, being of very variable strength, have caused many accidents. (Taylor on Poisons, p. 538.)

* Hobhouse's Albania, vol. ii. p. 944. See also Dr. Oppenheim, as quoted in British and Foreign Med. Review, vol. iv. p. 394.

† Madden's Travels in Turkey, vol. i. p. 27, American edition. Dr. Dekay; in his late work on Turkey, states that the opium-eaters are no longer to be seen in Constantinople. They would seem to be transferred to China. (See North British Review, vol. iv. p. 409.)

If the reader will refer to the chapter on *Insurance upon Lives*, (vol. i. p. 700,) he will see a case there stated which is connected with the subject. The individual in question had been in the practice of taking laudanum, in large quantities, for thirty years, and it was contended by the insurance office that this was a *habit tending to shorten life*, and ought to have been stated by him. The consequent discussion led Dr. Christison to make some inquiries, and he found that in most of the cases of opium eating which he could obtain, the expected result of shortening life had not occurred. It must, however, be recollected that in many instances the quantity consumed is very gradually increased, that its immediate bad effects must be early counteracted by remedies, or, what is probably most common, that the bowels become accustomed to its action, and preserve, in a measure, their healthy condition, and thus, that many individuals, if their original stamina be good, may linger on without any striking results, to the verge of old age. The effects, at all events, may be chronic, but I have equally no doubt that life is shortened, and particularly in young females who give themselves up to this habit. Besides the peculiar effects of the substance, its reiterated operation has an influence in inducing local excitement and a predisposition to organic affections. The cases on which these remarks are founded are unfortunately quite too numerous; and at a more convenient period I hope to be enabled to present some proofs of the alarming extent to which this pernicious habit is carried.*

* For Dr. Christison's remarks on this subject, see his *Toxicology*, second edition, p. 626; and *Edinburgh Medical and Surgical Journal*, vol. xxxvii. p. 123. Dr. Domeier mentions the case of an individual who has taken opium for twenty-four years, and is now fifty-one years old. He is, however, sallow, listless, and weak. (*London Medical Quarterly Review*, vol. iv. p. 482. See also *Lancet*, N. S., vol. ix. p. 710; vol. xvi. p. 685; vol. xxi. p. 177.)

Dr. O'Shaughnessy (*Bengal Dispensary*) remarks that in India "it has not been ascertained that this habit has a direct tendency to shorten life; on the contrary, the longevity of opium-eaters is, in many parts of the East, of proverbial notoriety." He applies the same remark to opium smoking, which appears to be as prevalent in Calcutta as in China. (*British and Foreign Medical Review*, vol. xvi. p. 356.)

Besides its administration by the mouth, poison has occasionally proved dangerous when used in the form of injection, or when applied to the abraded skin. Dr. Christison mentions the case of a friend who, in order to allay the irritation caused by a blister, applied an opium poultice to the scrotum. He fell into a state of profound sopor, which was luckily interrupted by a visitor. Sir Astley Cooper says he has known a solution of opium, applied to an extensive scald on a child, to destroy it.*

As to animals, crude opium, or its watery extract, when introduced into the stomach of dogs, caused within a few hours a weakness and paralysis of the posterior extremities, and convulsions of the muscles of the trunk and face. The pupils were not, however, more dilated than natural, and there was no moaning, but an extreme dejection. The paralysis and convulsions increased until death supervened. Similar effects were induced when the œsophagus was tied, except that death ensued earlier, from large doses.

When the watery extract was inserted into the cellular tissue of the thigh of a dog, paralysis of the posterior extremities, convulsions, and accelerated circulation, with trembling of the head and twitches of the lower jaw, occurred, and death followed in a much shorter time than in the previous series of experiments. The injection of the extract into the anus produced the earlier symptoms of the poison, but the animals recovered.

Dissection generally presented the digestive canal in a sound state. The lungs were usually livid and distended with blood, and that in the ventricles was often black and coagulated.†

* Lectures, vol. i. p. 79. A case is mentioned as occurring at La Charité, in Paris, where twelve drops of laudanum, used as an injection to allay the pain consequent on cauterization for a strictured rectum, produced all the symptoms of narcotic poisoning, and death in seventeen hours. (*Lancet*, N. S., vol. xi. p. 639. See also *ibid.*, vol. xxiii. p. 389.)

A case of poisoning, from the endermic application of acetate of morphia, is quoted from a French journal in *Edinburgh Medical and Surgical Journal*, vol. lvi. p. 296. The quantity used was only four-tenths of a grain. A remarkable case of chronic poisoning, by opium, may be found in the *Edinburgh Med. Journal* for 1835, vol. i. p. 357.

† Orfila's *Toxicology*, vol. ii. p. 110.

"According to the most recent inquiries, those of M. Charet, which were extended to every class of the lower animals, opium produces three leading effects. It acts on the brain, causing congestion, and consequently sopor; on the general nervous centre as an irritant, exciting convulsions; and on the muscles, as a direct sedative. It is poisonous to all animals, man, carnivorous, quadrupeds, the rodentia, birds, reptiles, amphibious animals, fishes, insects, and the *mollusca*. But of its three leading effects, some are not produced in certain classes or orders of animals. In the mammalia, with the exception of man, there is no cerebral congestion induced, and death takes place amid convulsions. In birds, there is some cerebral congestion toward the close, but still the two other phenomena are the most prominent."*

Symptoms and effects of morphine, narcotine, etc. Morphine. The action of morphine is nearly the same as that of opium, but it is more energetic. On its first discovery, Sertuerner supposed that in the solid state it had little effect, being nearly insoluble. This, however, is denied at present, and its insolubility is ascribed to its impurity, having contained more or less of narcotine.

According to Orfila, the following are the effects of pure morphine and its salts on animals: When the alkaloid is introduced into the stomach, it is dissolved apparently by the acid juices contained in the viscus. In large doses, it produces vertigo, dimness of sight, and in a great majority of cases, contracted pupils. A dose of two or three grains causes severe vomiting, pain in the stomach, diminished or suppressed urine, and, according to Dr. Bally, a severe itching of the skin.

If from forty to one hundred grains of the acetate of morphine be given to dogs and cats, the hind quarters are observed in a few moments to be weakened, and the gait becomes unsteady. The animals fall into a state of rest or sleep, but are easily roused by the least noise. The pulse is slow and intermittent; the pupil is either contracted, dilated, or natural; vomiting and purging occur, and there is more or less of

* Christison, p. 615, quoted from the *Revue Médicale*. See also Dr. A. T. Thomson's *Experiments on Dogs*, *Lancet*, N. S., vol. xxvii. p. 656.

salivation. At the end of an hour, convulsions ensue, and the mouth is full of froth. When the dose proves fatal, a few paroxysms usually precede death. No changes are detected in the alimentary canal, or other organs, on dissection.

If thirty or forty grains of acetate of morphine are injected into the cellular tissue, the animal dies in five or six hours, with symptoms similar to those already enumerated.*

There are a few cases in which its effects on man have been noticed. In 1829, a young Brazilian student of medicine at Paris took twenty-four grains of the acetate to destroy himself. In ten minutes he felt heat in the stomach, with excessive itchiness; in three hours and a half, dimness of vision occurred, and in an hour more he felt approaching stupor, and from this he sank into a state of profound insensibility. He was visited by Orfila, who found him cold, comatose, and affected with lock-jaw; the pupils were slightly dilated; the pulse 120; the breathing hurried and stertorous; the abdomen tense and tympanitic, and there were occasional convulsions. He was bled to forty ounces, sinapisms were applied, and stimulant enemata given. By means of these and cold applications, the symptoms were mitigated; the trismus diminished, so that strong coffee could be given. On the next day he had difficult and scanty micturition, with pain in the kidneys and bladder, and difficulty in swallowing. These went off during the second night.†

In another case, related by Castara, where fifty grains of acetate of morphine were taken, symptoms of coma supervened in twenty minutes. The limbs were flaccid, the pupils contracted, the face and lips livid, the skin warm and moist, the pulse full and hard, and deglutition impossible. Tartar emetic could not be given. He was then bled, upon which he started, as if from sleep, but could not see any one. He complained chiefly of intense itching and a general sense of bruising. In an hour, by being constantly roused, his consciousness

* Orfila's Toxicology, third edition, vol. ii. p. 62. Deguise, Depuy, and Leuret have also published a series of experiments with acetate of morphine. Paris, 1824.

† Edinburgh Medical and Surgical Journal, vol. xxxiii. p. 220.

was almost restored, and vomiting and purging followed from the exhibition of tartar emetic. After this he gradually recovered, the sleeping continuing all next day, and the itching of the skin even longer.*

Julia Fontanelle mentions the case of a child five years old, who was poisoned by the sulphate of morphine, given in an enema. The dose was ten grains; sleep followed in ten minutes, and shortly after it was seized with violent convulsions. The error was now discovered, but remedies proved in vain, and death happened in eleven hours.†

The famous case of Dr. Castaing, which occurred in France, belongs also to this division of our subject. He was supposed to have poisoned two brothers with the acetate. I shall give the particulars at the conclusion of the present article.

* Christison, p. 633; *Edinburgh Medical and Surgical Journal*, vol. xxxvi. p. 461.

† *Edinburgh Medical and Surgical Journal*, vol. xxxiii. p. 219. The following case was communicated to Dr. Christison, by Mr. Clark, of Montrose. A woman took, by mistake, ten grains of very pure acetate of morphine. It was almost immediately discovered, and the stomach was completely cleared by the stomach-pump. At this time, she was completely sensible. But stupor came on after the poison was evacuated, and deep coma followed, which resisted all means of removal. She died in about twelve hours. (Christison, third edition, p. 668.) Trousseau and Bonnet found the morphine and its salts acted with much greater rapidity when applied to the denuded skin than when taken internally. (*Annales d'Hygiène*, vol. ix. p. 229.) A case confirming this, is quoted by Dr. Dunglison from a German journal. A few grains spread over a blistered surface produced most alarming symptoms, which required the usual remedies to remove them. (*American Medical Intelligencer*, vol. ii. p. 13.)

The question, how small a quantity of morphine or its salts will produce poisonous effects, is copiously noticed in the *Lancet* for 1838, 1839, (vol. xxiii.) Several practitioners are stated to have found doses even under a grain to prove alarming.

Mr. Toogood mentions an instance of a lady, aged eighty, who had been in the habit of taking small doses of syrup of poppies at night, and to whom seven drops of the solution of the acetate of morphine, administered in its stead, proved fatal the next morning. (*Provincial Med. and Surgical Journal*, November 18, 1841.)

Dr. Houston, of Virginia, gives a case in which ten grains of sulphate of morphine, administered by mistake to a gentleman aged fifty-nine, and laboring under intermittent fever, caused death in less than two hours. Deep stertorous breathing was the only symptom noticed. Various remedies proved useless. (*American Journal of Med. Sciences*, N. S., vol. vi. p. 372.)

Narcotine, according to Orfila, in dogs whose gullet is not tied, incites vomiting, and the poison is discharged. But, on the other hand, if it be tied, death ensues in two, three, or four days, without any remarkable symptoms but languor and hard breathing. Magendie, however, found that it produced in dogs a state like reverie, accompanied with convulsions. They lie apparently asleep, but are really alive to external objects.

When narcotine was injected into the veins, its action was more rapid and powerful. In doses of three grains, it produced convulsive movements, stupor, and death.

Dr. Wibmer, of Munich, found, by experiment on himself, that two grains dissolved in olive oil produced merely slight, transient headache; that eight grains dissolved by means of muriatic acid had no effect at all; while the same quantity of solid narcotine occasioned headache and restlessness of mind, and trembling of the hands. Dr. Tully, from experiments on himself and others, deems it a powerful narcotic, producing contraction of the pupils, vertigo, nausea on motion, staggering in the gait. In two individuals vomiting was induced. The doses varied from two to four grains.*

Meconine was at one time supposed to be acrid, but Magendie injected it into the jugular of a dog without any effect. It has not been sufficiently examined.

Meconic acid is probably inert. Drs. Fenoglio and Blegnini, of Turin, gave eight grains of the acid, or of the meconates of soda or potash, to dogs, crows, and frogs, without any deleterious effects; and the same quantity was repeatedly administered to a horse, without any injury. The meconates, in doses of four grains, were then given to persons laboring under tape-worm, without any effect on them or the worms.†

Codeine, from the experiments of Kunkel on animals, produces tetanic convulsions and death. On dissection, he found the cerebellum and spinal marrow gorged with blood. When introduced into the cellular tissue, its action was violent, and exerted principally on the urinary organs—suspending the ex-

* Silliman's Journal, vol. xxi. p. 44; Boston Medical and Surgical Journal, vol. vii. p. 37.

† Brande's Journal, vol. xvii. p. 393.

cretion of urine.* Barbier, however, having used it therapeutically, thinks that it exercises no influence on the spinal marrow or its nerves.†

The results obtained are thus very contradictory.

Paramorphine seems to have a very marked action on the animal economy. Magendie destroyed a dog in a few minutes by giving one grain. It produced tetanic convulsions.‡ *Narceine* and *Pseudomorphine* are probably inert.

Paverine. This is a new principle announced by Robiquet, which is, according to him, soluble in water, and saturates the acids. It is poisonous, and acts in a very marked manner on the spinal marrow.§

Appearances on dissection, from opium or laudanum. I have already mentioned in the preliminary chapter on poisons that these are seldom very marked. The most striking will be seen in the narratives of a few examinations.

In a case where two drachms of opium produced fatal effects in six and a half hours, the body was covered with red-brown patches on the arms, shoulders, and back of the neck. The day after death the face was pale and the mouth filled with froth. There was a general congestion of black blood in the brain; the dura mater was injected, and even the capillaries gave out, on incision, minute drops of black blood. The heart was filled with the same, as were the lungs; the bronchiæ were reddish. The stomach was swollen, and had red-brown patches at its fundus. The intestinal mucous membrane was minutely injected—the effect of congestion, and not of inflammation. The liver and spleen were gorged with blood, and the bladder and kidneys sound.||

In Mr. Stanley's case, related in the Transactions of the London College of Physicians, water was found in the cellular tissue of the pia mater, covering the greater part of the cere-

* Philadelphia Journal of Pharmacy, vol. vi. p. 88, from Revue Médicale.

† Lancet, N. S., vol. xiv. p. 118.

‡ London and Edinburgh Philosophical Magazine, vol. iv. p. 77. Dr. Carson on Codeia, in Philadelphia Medical Examiner, vol. i. p. 415.

§ London and Edinburgh Philosophical Magazine, vol. ii. p. 153. Magendie corroborates its powerful deleterious qualities. (London Medical Quarterly Review, vol. iv. p. 306.)

|| London Med. Repository, vol. xiv. p. 426.

brum; but in other respects the brain had no unusual appearance. The stomach was contracted, and filled with a fluid, not resembling laudanum either in color or smell. There was no inflammation present.*

In Mr. Cornish's case, coagulable lymph was effused between the dura mater, the arachnoid coat, and the pia mater; and there was rather more fluid than is usual in the lateral ventricles. The stomach was natural, and the bladder contained about a pint of urine.†

In commenting on the appearances observed, Dr. Christison remarks that turgescence of the vessels in the brain, and watery effusion in the ventricles and on the surface of the brain are generally met with. In a case examined by him, each ventricle contained three drachms of fluid, and the arachnoid membrane on the surface of the brain was much infiltrated. "But congestion and effusion are by no means universal."‡

Extravasation of blood is a rare occurrence. Our author quotes a case related by Mr. Jewel, of London. In a young female, who died eight hours after taking two ounces of laudanum, several clots were found in the substance of the brain, and one which lay in the anterior right lobe was an inch long.§ Dr. Granville mentioned another at a meeting of the Westminster Medical Society, in November, 1827, where extravasated blood was found in various parts of the brain.||

* Transactions, vol. vi. p. 414.

† London Medical and Physical Journal, vol. xxxi. p. 193. The same state of the bladder was seen in another case. (Ibid., vol. xxviii. p. 80.)

‡ Dr. Bright, in a case examined by him, found great turgescence of the vessels, and the substance of the brain was filled with bleeding-points, but there was no water in the ventricles. (Medico-Chirurgical Review, vol. xix. p. 327.)

Dr. Duffee, in a child three years old, poisoned by laudanum, found similar turgescence, and about a drachm of serum in the ventricles. The blood was fluid and very dark. (American Medical Intelligencer, vol. iii. p. 281.) See also Dr. Skae's case in Edinburgh Medical and Surgical Journal, vol. liv. p. 151.

§ Christison, p. 637, from the London Medical and Physical Journal, vol. lv. p. 111.

|| Lancet, vol. ix. p. 339. Another instance is mentioned by Dr. Clarke. (Coxe's Medical Museum, vol. v. p. 88.)

The lungs are generally, but not universally, gorged with blood.* The stomach is in most cases natural; in a few the villous coat is red, but it is probably never inflamed. There is only one case in which this is positively stated to have been present.†

Lividity of the skin is quite common, and so also is fluidity of the blood. But this last is not invariable. Four cases are cited by Dr. Christison, in which the blood was found coagulated in the cavities of the heart.‡

The bodies of persons poisoned by opium also generally pass rapidly into putrefaction.§

The poison cannot always be found in the stomach. "This may arise from two causes. It may be all absorbed, as will

* In a letter from Dr. Clarke to Dr. Rush, dated at Verdun, in France, in 1807, it is stated that in a young man found dead in bed from taking laudanum, the trachea and air-vessels of the lungs were completely filled with frothy blood, and some blood issued from the mouth; every other part was natural. (Coxe's Medical Museum, vol. v. p. 88.)

† It is quoted from Lassus by Orfila, (Toxicology, vol. ii.) A woman, aged sixty, took thirty-six grains of opium, and in five or six hours after was found asleep, with apoplectic symptoms. She recovered, however, so as to tell what she had done. Ipecacuanha was given, and afterwards vinegar, but without effect. She soon became insensible, and died in eleven hours after taking it. On dissection, the stomach was found inflamed, and in some parts eroded; the brain was natural. As Lassus saw this female but once, it is supposed that probably some corrosive substance had also been taken. (Merat, Dictionnaire des Sciences Médicales, vol. xxxvi. p. 505.)

‡ Another is given by Dr. Charles A. Lee. (New York Medical and Physical Journal, vol. viii. p. 297.)

§ I find a very interesting case of poisoning, by opium, in the Boston Medical and Surgical Journal, vol. xi. p. 285. The details are as follows: A healthy man, aged twenty-eight, purchased an ounce of opium, and probably took all. On his way home he was observed to be merry. He went to bed, and his wife noticed his breathing to be frequent; but in reply to questions, he said he was well. His face was ghastly and his eyes had lost their expression; yet his conversation was rational and his mind clear. A person present, thinking the case a serious one, opened a vein, but after an ounce had been drawn, the bleeding stopped, and the man died, certainly not more than two and a half hours after taking the opium. On dissection, the right ventricles and vena cava were found filled with blood. In the stomach, there was from half an ounce to an ounce of opium; some half dissolved, but the most in masses. There was a slight redness of the mucous coat. The lungs were empty and the surface of the body pale.

often happen when it has been taken in the liquid form, or it may be partly absorbed and partly decomposed by the process of digestion. But in one or other of these ways it may certainly disappear, and that in a very few hours only."* Cases in which it was detected after death will be hereafter mentioned.

I have already mentioned, at page 415 of this volume, that Orfila and Lesueur have ascertained that opium and the salts of morphine do not undergo decomposition by being long in contact with decaying animal matter. "Even after many months they may be discovered, at least the putrefaction of the matter with which they are mingled does not add any impediment in the way of their discovery. It is only necessary to observe that the alkaloid may be rendered insoluble by the evolution of ammonia, which separates it from its state of combination."†

Chemical proofs. In noticing these, I shall reverse the order so far as first to mention those of the principles contained in opium.

Tests for meconic acid. This acid may be procured thus: Precipitate a strong watery infusion of opium with acetate of lead. Add ten or twelve parts of water to the impure meconate of lead that has thus been thrown down, and transmit through it a stream of sulphuretted hydrogen. Evaporate and crystallize the acid obtained. The crystals may be subjected a second time to precipitation with acetate of lead, and decomposition by sulphuretted hydrogen.

[1. When pure, the acid is in white, transparent micaceous scales; more commonly these are of a reddish color; it is soluble in 125 parts of cold and in 4 parts of boiling water, from which it is again precipitated on cooling. By the continued action of boiling water, meconic acid is decomposed, carbonic acid given off, and a new acid (comenic) remains in

* Christison, p. 639. Cases in which it could not be found, are mentioned in London Medical Repository, vol. xiv. p. 426. Edinburgh Med. and Surgical Journal, vol. xix. p. 196, by Dr. Christison. London Med. and Physical Journal, vol. xxxi. p. 193, by Mr. Cornish. London Med. Gazette, vol. xviii. p. 851, by Mr. Pereira.

† Christison, p. 640.

solution. Heated, meconic acid loses water and carbonic acid, and sublimes, according to the degree of heat employed, either as meconic or pyromeconic acids. Both these new acids have the same reaction with the persalts of iron as the meconic.—B. W. McC.]

2. When dissolved even in a very large quantity of water, the solution acquires an intense cherry-red color with the permuriate or persulphate of iron.*

3. This solution gives a pale-green precipitate with the solution of ammoniated copper; and if the precipitate is not too abundant, it is dissolved by boiling, but reappears on cooling.

4. It yields whitish precipitates, soluble in nitric acid with nitrate of silver, acetate of lead, and chloride of barium.

Practically, reliance is mainly to be placed on the iron test; 1-500th part of a grain dissolved in a small quantity of water may be detected by this test. (Taylor.) Sulphocyanic acid, or an alkaline sulphocyanide, strikes a red color with a persalt of iron, but this color is readily discharged by a few drops of a solution of corrosive sublimate or chloride of tin, which is not the case with the color produced by meconic acid.

Tests for morphine and its salts. Morphine, when pure, is in small, beautiful white crystals. It has a bitter taste, but no smell. A gentle heat melts it, and a stronger one reddens and then chars the fused mass, from which issue white fumes, and at last the mass kindles and burns brightly. Morphine is very little soluble in water, more so in ether; but its proper solvents are alcohol and the diluted acids. All its solutions are intensely bitter.

Nitric acid dissolves morphine with effervescence, and the solution becomes instantly orange red; and if too much acid has been used, it changes quickly to yellow. This property it possesses in common with brucine, and also strychnine, when not quite pure.† When suspended in water in the form of a

* According to Pereira, mustard will also strike a red color with a salt of iron. (London Med. Gazette, vol. xviii. p. 852.)

† To distinguish these, Dr. Vassal proposes to use hydrochlorate of tin. If the liquid contains morphine, it will become yellow; if brucine, a violet color; and if strychnine, it becomes colorless. (London Med. Repository, vol. xxvi. p. 455.)

white powder, and then treated with a drop or two of permuriate of iron, it is dissolved, and forms a deep greenish-blue solution, the tint of which is more purely blue the stronger the solution and the purer the morphine.*

Iodic acid is decomposed by morphia, the resulting iodine giving a blue tint to starch.

Acetate of morphine, though white when pure, is usually of a brown color. The stonger acids disengage acetic acid. The alkalies, and particularly ammonia, throw down morphine from its solution in water, with a white precipitate. Nitric acid and permuriate of iron act on it as on morphine.†

Hydrochlorate (muriate) of morphine. This decrepitates slightly when heated, and then melts, and at the same time chars and exhales a strong odor. Nitric acid and permuriate of iron act on it as on morphine.

M. Serullus, in 1830, proposed iodic acid as a test for morphine and all its salts. He found that when it was brought in contact with the alkaloid, even in very minute quantities, iodine was disengaged, and a blue color was communicated to starch. He further states that this effect is peculiar to morphine, and that the other vegetable alkalies, as strychnine, veratrine, and brucine, etc., have no action on iodic acid.‡

* Pelletier has ascertained that this blue color is owing to the morphine attracting a portion of the peroxide of iron, and then uniting with another portion of the protoxide, forming thus a morphite of the metal. (Lancet, N. S., vol. xi. p. 337.)

† Raspail mentions that the concrete part of the oil of cloves exactly imitates morphine when treated by each of the above tests. (Chemistry, p. 523.)

‡ Philosophical Magazine and Annals, vol. ix. p. 149; Lancet, N. S., vol. viii. p. 4. Pelletier approves of this as a very minute and accurate test. I observe, however, that Mr. Lewis Thompson, of London, denies that iodic acid can be depended upon as a test of morphine, as it affords, according to him, a similar result with sulphocyanic acid, the sulphocyanates of soda and potash, albumen, arsenite of potash, etc. (London Medical Gazette, vol. xix. p. 188.) Mr. Meeson, of London, has suggested, January, 1835, the following as a test of morphine and its salts: To the suspected fluid add a strong solution of chlorine. If ammonia be added to this, the solution will take a dark-brown color, which will disappear by adding more chlorine. No other vegetable alkali, he adds, takes this character. With quinine, the same experiment gives a beautiful green color. (London and Edinburgh Philosophical magazine, vol. vi. p. 158.)

Tests for narcotine. Its crystals, when pure, fuse with heat, and concrete on cooling, into a resinous-like mass. They are soluble in ether or fixed oil in 100 parts of cold or 24 parts of boiling alcohol; insoluble in water or the alkalies, and very soluble in the diluted acids. The tests of morphine and its salts, which I have mentioned above, do not produce any similar effects on narcotine. [Nitric acid dissolves it, acquiring a yellow color; with sulphuric acid a bright sulphur yellow is produced; if to the mixture of strong sulphuric acid and narcotine a fragment of nitrate of potash be added, a deep blood-red color makes its appearance. Under similar treatment, morphia produces a brown or olive-green color.]

Codaine is distinguished from morphine by not becoming blue with perchloride of iron, nor does ammonia precipitate it from its solution in muriatic acid.

Paramorphine is distinguished from morphine by its not reddening with nitric acid, nor becoming blue with perchloride of iron, nor forming crystallizable salts with acids; from narcotine, from its being more soluble in alcohol; while nitric acid melts it into a soft resinous substance before dissolving it.

Test for opium in solution. Dr. Hare, of Philadelphia, has published the following. It is founded on the property of meconic acid to precipitate with lead:—

Add a few drops of acetate of lead to a weak solution of opium, (even that contained in ten drops of laudanum, diffused in half a gallon of water.) The meconate of lead will precipitate, but this may require from six to twelve hours. When it is collected at the bottom of the vessel in a mass, about thirty drops of sulphuric acid should be poured on it through a glass tube. Let this be followed by as much of the permuriate of iron. The sulphuric acid liberates the meconic, and thus enables the latter to produce the appropriate color (cherry red,) of meconate of iron.*

Orfila, while commending this test, suggests that as it is only necessary to have meconic acid in a free state for the

* Chapman's Journal, N. S., vol. v. p. 77. Dr. Christison suggests as an improvement, to throw off the superincumbent fluid before the acid and iron are added.

iron to strike its red color, we may act directly on the meconate of morphine contained in opium by sulphuric acid. The meconic acid will thus be liberated and ready for the action of the test.*

Process for detecting opium in mixed fluids and solids. The following is recommended by Dr. Christison as the most delicate and satisfactory:—

"1. If there be any solid matter, let it be cut into small fragments; add water if necessary, then a little acetic acid to render the mixture acidulous; and when the whole mass has been well stirred and has stood a few minutes, filter and evaporate, at a temperature somewhat below ebullition, to the consistence of a moderately thick syrup. To this extract strong alcohol is to be gradually added, care being taken to break down any coagulum that may be formed; and after ebullition and cooling, the alcoholic solution is to be filtered. The solution must then be evaporated to the consistence of a thin syrup, and the residue dissolved in distilled water and filtered anew.

"2. Add now the solution of acetate of lead; as long as it causes precipitation, filter and wash. The filtered fluid contains the morphine, and the precipitate on the filter contains meconic acid united with the oxide of lead.

"3. The fluid part is to be treated with sulphuretted hydrogen, to throw down any lead which may remain in solution. It is then to be filtered with cold, and evaporated sufficiently in a vapor bath. The solution in this state will sometimes be sufficiently pure for the application of the tests of morphine; but in many cases it is necessary, and in all advisable, to purify it still further. For this purpose the fluid is to be precipitated with ammonia, and the precipitate having been collected, washed, and drained on a filter, the precipitate and portion of the filter to which it adheres are to be boiled in a little pure alcohol. The alcoholic solution, filtered if necessary, will give, by evaporation, a crystalline residue, which becomes orange red with nitric acid, and, when suspended in water, becomes blue with permuriate of iron. The latter pro-

* North American Medical and Surgical Journal, vol. vi. p. 201.

perty I have sometimes been unable to develop when the former was presented characteristically.

"4. It is useful, however, to separate the meconic acid also, because, as its properties are more delicate, I have repeatedly been able to detect it satisfactorily when I did not feel satisfied with the result of the search for morphia. Dr. Ure made the same remark in his evidence on the trial of Stewart and his wife. He detected the meconic acid, but could not separate the morphine. Suspend, therefore, in a little water the precipitate caused by the acetate of lead, (paragraph 2,) transmit sulphuretted hydrogen until the whole precipitate is blackened; filter immediately without boiling, then boil, and, if necessary, filter a second time. A great deal of the impurities thrown down by the acetate of lead will be separated with the sulphuret of lead, and the meconic acid is dissolved. But it requires, in general, further purification, which is best attained by again throwing it down with acetate of lead, and repeating the steps of the present paragraph. The fluid is now to be concentrated by evaporation, and subject to the tests for meconic acid, more particularly to the action of perchloride of iron, when the quantity is small. If there is evidently a considerable quantity of acid, a portion should be evaporated till it yields crystalline scales, which have always a yellowish tint, and these are to be heated in a tube, to procure its arborescent crystalline sublimate. About a sixth of a grain of meconic acid, however, is required to try the latter test conveniently."*

I find, also, the following method recommended for the detection of morphine and meconic acid in mixtures abounding in organic matter: The solid contents of the stomach and other substances must be sliced, bruised, and treated with

* Christison, p. 608. This process is founded, as Dr. Christison states, on that proposed by Lassaigne some years previous. The directions contained in the three first paragraphs are principally taken from him. For the details of Lassaigne's process, see Brande's *Journal*, vol. xvii. p. 168; *Edinburgh Medical and Surgical Journal*, vol. xxii. p. 231.

MM. Larocque and Thibierge failed in several experiments with mixed fluids in decomposing meconate of lead by sulphuretted hydrogen. The inequality of composition in the opium of commerce is suggested as one of the causes of this. (*Chemist*, vol. iv. p. 177.)

successive quantities of distilled water. The different liquids are to be collected and the solid residue pressed. The solid residue is now to be treated with an excess of diluted muriatic acid, to which distilled water is then to be added, and the whole allowed to digest for from eight to ten hours. At the end of this time, pour off the liquid and press again the residue. The liquids thus obtained by these two processes are now to be mixed and evaporated to dryness in a water bath; digest the dry mass in two successive portions of boiling alcohol, filter the solutions and evaporate to the consistence of syrup. Preserve the residue on the filter for the subsequent extraction of meconic acid. Precipitate now the alcoholic solution with ammonia, as recommended by Dr. Christison in paragraph 3. and evaporate and redigest in alcohol until crystals of morphine are obtained. For the extraction of meconic acid, the residue on the filter is to be digested in a dilute solution of ammonia filtered, and the excess of alkali neutralized by acetic acid. Acetate of lead is now to be added until there is no further precipitate. The precipitate, which is meconate of lead, is to be collected on a filter, well washed, and then boiled for some time with very dilute sulphuric acid. On filtering this liquid, the sulphate of lead remains on the filter, while the solution of meconic acid passes through.*

Although these tests may appear ample and satisfactory, yet we must remember that in most cases the search will be for substances which exist in small proportion in opium; (as, for example, Turkey opium probably does not contain more,

* Dr. Gusserow, quoted in *British and Foreign Med. Review*, vol. v. p. 213.

I find in some late journals, that the effects produced by the inoculation of morphine are recommended as a test of the presence of that substance in very minute quantities. According to M. Martin Solon, a small pimple with a diffuse rosy areola is formed in a minute and a half after insertion with a lancet, of the aqueous solution. In about twenty minutes, the pimple becomes flattened, and its areola, which is very red, is about an inch and a half in diameter. In an hour, these appearances diminish, and gradually vanish from twelve to twenty-four hours after the operation. Some constitutional effects are also experienced. It is, however, at best, only a presumptive, and may be a deceptive proof. (*British and Foreign Medical Review*, vol. iv. p. 506.) Lafargue, in *Bulletin de l'Académie Royale de Médecine*, vol. i. pp. 13, 40, 249.

at the highest, than ten per cent. of morphine.) The operator must, therefore, expect to find only minute traces, while in many instances he may be altogether disappointed. This has happened to accurate chemists, as Christison, Buchner, and Reid.*

I have mentioned that the solution of meconic acid, as well as its crystals, acquire an intense-red color with the permuriate of iron. Now it has been found that another acid, the *sulphocyanic*, is affected in a precisely similar manner by that test. Were this substance a rare one, as was once supposed, there could be little danger of mistake. But Gmelin and Tiedemann, and subsequently other observers, have found it to exist in *human saliva*.

Dr. Christison observes, "that it is impossible to procure a blood-red coloration from the saliva, except by evaporating a large quantity to dryness, and dissolving the residue in a small quantity of water;" and he questions whether it can be separated at all after the saliva is mixed with the complex contents of the stomach.† Dr. O'Shaughnessy has proposed the following, as a means of discriminating between the two acids: Add a small quantity of a solution of pure potash. This destroys the color of the sulphocyanate, making it a dead-pale white, but renders that produced by the meconate more intense. He further adds, that by the use of sulphuretted hydrogen, as directed in paragraph 3, any sulphocyanate of lead that may be formed is dissolved away by the water employed in the ablution of the precipitate.‡ The precipitate, with the nitromuriate of gold, will also serve to distinguish it.

The best distinction, however, according to Dr. Christison, is that procured by Dr. Percy. Acidulate the red fluid with

* Edinburgh Medical and Surgical Journal, vol. xxxiii. p. 70; Christison, p. 609; Reid's Chemistry, second edition, p. 416. When every other proof has failed, the peculiar odor of opium has in several instances remained, so as to identify the substance. Stas' process for the extraction of morphia in organic mixtures containing opium is given by Taylor. (Poisons, p. 556.)

† Christison, p. 611.

‡ Lancet, N. S., vol. vii. p. 33. Mr. Everitt proposes, instead of potash, to use a solution of corrosive sublimate. This also bleaches the mixture, if the color depends on sulphocyanic acid, but has no effect on meconic. (Ibid., vol. xxiv. p. 199.)

sulphuric acid, drop in a piece of pure zinc, and suspend at the mouth of the tube a bit of paper moistened with solution of acetate of lead. If the redness be caused by sulphocyanic acid, hydrosulphuric acid gas is evolved, and blackens the paper. No such effect ensues if the redness be owing to meconic acid.*

Edmund Castaing, of a respectable family in France, studied the medical profession with ardor and success, and in due time became a physician. He was very intimate with Hippolyte and Augustus Ballet, young men of fortune. The former was out of health, and consulted him as a medical adviser.

In this state of things, Hippolyte died on the 22d of October, 1822. Having been deemed an invalid for some time, his death did not become the subject of remark, and Augustus remained on as intimate terms as before with Castaing. It was, however, ascertained subsequently, that while the disease under which Hippolyte was laboring (consumption) was pursuing its usual slow course, he was suddenly seized with severe symptoms, which carried him off in four days. He died in the arms of Castaing, and, according to that person, would not see his relatives. He made a will in favor of Castaing, and did not mention his brother's name in it. This will Castaing, according to the testimony of a female witness, sold to Augustus for 100,000 francs. The physicians who examined the body of Hippolyte stated that there was emaciation present, but not sufficient to warrant them in ascribing death to exhaustion, (*epuisement*.)

On the 30th of May, after having spent two days in excursions in the country, Augustus Ballet, accompanied by Castaing, arrived at St. Cloud, in a small carriage, and without his usual establishment of servants. They put up at a tavern. In the course of the evening Augustus complained of being unwell. He took some warm wine, to which sugar and citron were added by Castaing, but without relief. He passed the night in a disturbed state. Castaing left him at 4 A.M. to take, as he said, a walk in the park; but instead of doing this, he

* Christison on Poisons, fourth edition; Percy, *Lancet*, July 31, 1841; Dr. J. L. Smith, *Silliman's Journal*, September, 1845.

went to Paris, called at the shop of a druggist, and demanded and obtained twelve grains of an emetic. He signed an order for this, as the shop boy hesitated to give him so large a quantity. He then went to the shop of Chevallier, a *pharmacien*, and bought a *demi-gros* of acetate of morphine, saying that he wanted it for experiments on animals. He mounted his cabriolet, returned with all speed, and found Augustus still ill. He now prescribed some cold milk, and gave it to his patient. In five minutes he was seized with convulsions, and in half an hour violent vomiting came on, followed by purging. The servant of Augustus received a note from Castaing on this day, (31st,) saying that his master was ill. He hurried to St. Cloud, and found him laboring under the above.

A physician (Dr. Pigarche) was sent for, who arrived at 11 A.M. Augustus was easy; the vomiting had ceased, but there was some fever; the tongue was yellow, and there was slight pain in the bowels. Deeming the disease cholera morbus, on the representation of Castaing, he prescribed emollient fomentations, light diet, and an enema. At two o'clock he found Ballet free of fever, and expressing a desire to return to Paris. At 4 P.M. and at 7 P.M., though there was some excitement, yet everything augured favorably. He was sent for at 11 P.M., and found his patient quite insensible, unable to swallow, bathed in a cold sweat, with a small pulse, a burning skin; the jaws locked, the neck rigid, the abdomen tense, and the limbs affected by spasmodic convulsions. Bleeding produced a slight remission of these symptoms. At 6 A.M. Dr. Pelletan arrived from Paris. Stertorous breathing was now present. Sinapisms and even boiling water were applied to the legs, but they excited but little sensibility. The pupil of the eye was noticed at this time to be much contracted. Death followed an hour after mid-day.

The only appearances found on the dead body that bore any relation to the poison suspected, were congestion of blood and serous effusion in the vessels of the cerebral membrane.

Vauquelin and Barruel analyzed the liquid found in the stomach, but could find no trace of poison.

Orfila, on his examination, stated that the symptoms present were common to poisoning and ordinary diseases; and further,

that poisons might cause death and yet not be detected, owing to their removal by vomiting or absorption.

Magendie concurred in these opinions.

Chaussier was a witness for the accused.

He was one of the commission that examined the body of Augustus and the liquid found in the stomach. He stated that there was only a slight irritation of the stomach, and not a vestige of poison. He was asked whether the appearances on dissection might not be those of vegetable poisons? He answered no. Might they not have been absorbed into the blood? Yes; but it requires a long time. But when there is vomiting and purging? Then everything is evacuated. He was also asked whether the acetate of morphine could be detected? *Yes, to a molecule.* But when it is absorbed, is it then possible to find it? It requires a long time to absorb, and when the poison cannot be found, the *corpus delicti* is wanting. Does acetate of morphine produce a dilatation of the pupil? Yes. You do not agree with Dr. Orfila? I have experience that Dr. Orfila does not possess.

M. Roussel, the counsel for the accused, urged that the symptoms were those of an inflammatory disease. It might have been excited by the fatigue of his excursions, by his long walks in the sun, the warm wine, etc.

It was proved that Castaing had paid much attention to the subject of poisons, and had bought a considerable quantity of acetate of morphine. He was convicted and executed. Whether from circumstantial or moral evidence, there seems to be little doubt of his guilt in France, but the proofs of it, as developed on the trial, are certainly imperfect. It is highly probable that if Augustus was poisoned, other deleterious substances besides the acetate of morphine were administered.*

* *Causes Célèbres du XIX. Siècle*, vol. iv. pp. 1 to 103; *Proces de Castaing*. Gordon Smith, on Medical Evidence, p. 368; Christison, p. 634; *London Medical Repository*, vol. xxi. p. 87. *Considerations Médico-legales sur un accusation d'empoisonnement par l'acetate de morphine*, par E. S. Montmahou, M. D., etc., 8vo., Paris, 1823. This last denies that any poison was given.

In Scotland, the felonious administration of laudanum or other narcotic or deleterious drug, with intent to produce stupefaction, whether in malice or

A man was poisoned a few years since at Glasgow, by adding laudanum to strong beer. The peculiar smell of opium was manifest in the liquor extracted by the stomach-pump. The magistrates requested Dr. Ure to examine the contents of the stomach. "One portion treated with acetate of lead afforded an insoluble precipitate, from which an acid, strongly reddening permuriate of iron, was separated by the agency of the sulphuric. Another portion afforded directly, with a few drops of the permuriate of iron, an evident reddish-brown tinge. The chemical facts, joined to a body of circumstantial evidence, led to the conviction of the guilty pair, a man and wife, who were accordingly executed."*

Treatment. Probably no poison is more frequently used in this country, as a means of suicide, than opium. It hence becomes a matter of special importance that the physician be well acquainted with the modes of preventing its effects, and for much useful information on this we are greatly indebted to the investigations of Orfila.

The first indication is to remove the poison from the stomach. This is to be attempted in various ways. *By emetics* of sulphate of zinc or sulphate of copper. The former is by far the best, and it should be given in doses of half a drachm or two scruples, to be repeated at short intervals, if the first should fail to operate. The throat should also be irritated with a feather. At the same time, in order to insure its action, it is of great use to keep the patient roused as much as possible. Two persons should be constantly employed in dragging him up and down, and not permit him to sink into a state of insensibility.†

The sulphate of copper, although it is emetic in its operation,

to facilitate the commission of any crime, subjects the offender to severe punishment. (Alison's Principles of Criminal Law of Scotland, p. 629.) I presume the law in this State (see vol. ii. p. 412 of this work) would include this under the term *injury*.

* Dr. Ure, in Brande's Journal, N. S., vol. vii. p. 60.

† Successful cases, in which sulphate of zinc was the principal agent, are given by Dr. Kinnis, Edinburgh Medical and Surgical Journal, vol. xiv. p. 603; by Dr. Howison, *ibid.*, vol. xviii. p. 49; by Dr. Kennedy, *ibid.*, vol. xviii. p. 343.

is not by any means so safe a prescription as the former. It is, as we have already stated, an active poison, and if retained long in the stomach, may prove injurious.* But of all the forms of emetic medicine in use, tartar emetic is most to be discouraged. I have only to refer to its effects in large doses. And the practitioner, before he gives it, should recollect the possibility of its retention in the stomach, without producing vomiting. The torpid condition of that viscus is one of the main difficulties with which we have to contend. In confirmation of this opinion, Dr. Christison quotes a case in which a scruple of tartar emetic was administered to cause vomiting, but to no purpose. When it had remained fifteen minutes, sulphate of zinc was also given, and with immediate effect. But the patient, after recovering from the immediate consequences, was seized with pain in the stomach and bowels, and diarrhoea, which lasted for several days.†

A second mode of removing the poison from the stomach is the use of the *stomach-pump*. I have adverted to the history of its introduction in a previous page; and I may now add that it has proved of more service in cases of poisoning by opium than in any other. Numerous instances of its utility have accumulated in the periodical journals.‡ Dr. A. T.

* Dr. Marcet, *Medico-Chirurgical Transactions*, vol. i. p. 77, used it successfully in an almost desperate case, where six ounces of laudanum had been swallowed. Fifteen grains were given, and they induced vomiting. The patient complained for some days after of soreness in the throat and at the root of the tongue.

† *Edinburgh Medical and Surgical Journal*, vol. vii. p. 305; case by Mr. McKechnie.

It has also been advised to add stimulants, as mustard or Cayenne pepper, to the emetics. Several successful cases are given. (*Lancet*, N. S., vol. xxvii. p. 656.) Dr. Seymour advises powdered flour of mustard, one teaspoonful to a tumbler of water, repeated until vomiting is induced, in the cases where the stomach appears paralyzed. (*Ibid.*, vol. xxxii. p. 587.)

‡ Mr. Jukes, in 1822, particularly called the attention of the English medical profession to the utility of this remedy. (*London Medical and Physical Journal*, vol. xlviii. p. 384.) Mr. Bryce, as a substitute, proposed a long œsophagus tube, to which a bladder is attached. The fluid is introduced by it into the stomach; and when it is proposed to extract it again, the extremity of the tube and bladder is depressed below the level of the stomach;

Thomson advises that instead of pure water, a weak solution of carbonate of potash or of ammonia be employed, in order to decompose the opium and to diminish the solubility of the morphine.

"The last method of removing opium from the stomach is a desperate one, which can only be recommended when emetics by the mouth have utterly failed, and when a stomach-pump, or Mr. Bryce's substitute, cannot be procured. It is an injection of an emetic into the veins. Tartar emetic answers best for this purpose, and its effect is almost certain; a grain is the dose. While injecting it care must be taken by the operator not to introduce air into the vein."*

The next most important part of the treatment is to keep the patient constantly roused.† This is to be accomplished by the means already stated, of dragging him across the room between two persons; and the duration of this exercise should vary, according to circumstances, from three or six to twelve hours; and even if allowed to rest for a little time, he must be roused at short intervals, and any tendency to insensibility counteracted by renewed exercise. It is at this period also that dashing cold water over the head and body has been found

it thus acts as a siphon. (Edinburgh Medical and Surgical Journal, vol. xxiii. p. 220.)

Among the cases in which the stomach-pump has been successfully used, I can only refer to those by Dr. Moore, of New York, *New York Medical and Physical Journal*, vol. iv. p. 91; vol. vi. p. 357. By Dr. Hamersley, *ibid.*, vol. ix. p. 235. Dr. Charles A. Lee, *ibid.*, vol. vii. p. 518. Dr. Bardsley, of Manchester, *Edinburgh Medical and Surgical Journal*, vol. xxx. p. 306. *Lancet*, vol. v. p. 218; vol. vi. p. 517; vol. x. p. 245. Dr. Shipman, *American Journal Medical Sciences*, vol. xxvi. p. 508. Mr. Hooper, *Lancet*, December 16, 1843.

* Christison, p. 642. Prof. Alison cured a case with Mr. Bryce's tube. (*Edinburgh Medical and Surgical Journal*, vol. xxiii. p. 416.)

† Sir Walter Scott mentions the following striking illustration of this: One of the Duke of Buccleuch's farmers gave to his son, by mistake, some laudanum. It was instantly discovered. "While all around the young man were stupid with fear, he rose, saddled his horse and rode to Selkirk, (six or seven miles,) thus saving the time that the doctor must have taken in coming to him. It is very curious that his agony of mind was able to suspend the operation of the drug until he had alighted, when it instantly began to operate. He recovered perfectly." (*Lockhart's Life of Scott*, vol. ii. p. 279, American edition.)

of especial service in rousing the sensibility of the patient, and it would likewise seem to insure the operation of emetics. When, therefore, an emetic has been taken, and its effect is delayed, it is advisable to use the cold water.*

I would also recommend a trial, in difficult cases, of the *alternate* use of cold and warm water, as advised by Dr. Boissragon. He adduces several successful cases, in which the feet were immersed in a warm bath, while cold affusion was practiced on the head and shoulders. The feet may be even withdrawn for a few seconds and immersed in cold water, but should be immediately replaced in the warm. It is doubtless, as he supposes, in consequence of the *alternate impressions*, aided by the general means already recommended, that we are to hope for successful results.†

Internal stimulants sometimes prove useful assistants. Ammonia, occasionally but carefully applied to the nose, and injections of assafoetida, have each proved of service.‡

* This treatment, according to Dr. Christison, was first proposed in 1767, by Dr. Grater, a German physician. Successful cases in which it was a leading remedy, are related by Mr. Wray and Dr. Copland, in *London Med. Repository*, vol. xviii. pp. 26 and 29. By Dr. Crampton, *Dublin Hospital Transactions*, vol. iv. By Dr. Richardson, of Kentucky, (1821,) *Chapman's Journal*, vol. viii. p. 398. By Dr. Jackson, *ibid.*, vol. viii. p. 150. By Dr. John B. Beck, *New York Medical and Physical Journal*, vol. iii. p. 474. By Dr. Staats, *ibid.*, vol. iii. p. 473. In this case bleeding was also very useful. Dr. Cross, in an essay on poisoning by opium, (*Pennsylvania Journal*, vol. i. p. 469,) has collected all the successful cases up to the period when he wrote.

† *London Medical Gazette*, vol. xxv. p. 878; *Lancet*, N. S., vol. xxvi. p. 897. Dr. Marshall Hall advises that in those cases where an emetic, an antidote, or a stomach-pump be not immediately at hand, or even when the first has been given without inducing any operation, to employ external pressure on the abdomen in aid of irritating the fauces. Their simultaneous employment is what he urges. "The patient may be placed leaning with the stomach over a chair, protected by a pillow, while the fingers are introduced to irritate the fauces." (*Lancet*, N. S., vol. xxxi. p. 302.)

‡ Pulling the hair, injecting water into the ears, whipping with cords, flagellations on the palms of the hands and soles of the feet, slapping between the shoulders, etc., have been used to produce external irritation, and thus rouse the patient. See Dr. Joseph M. Smith, *Transactions of the Physico-Medical Society of New York*, p. 289. Dr. Seaman, *New York Medical Repository*, vol. iii. p. 250. Dr. Barret, *Boston Medical and Surgical Journal*, vol. xiv. p. 197. A case in which emetics produced no effect, and oil of turpen-

After the poison has been removed, it is often necessary, in consequence of the fullness and strength of the pulse, and the supervention of apoplectic symptoms, to abstract blood. In several cases, the relief thus afforded has been striking and permanent.* "It ought not to be resorted to till the poison is thoroughly removed from the stomach, for it favors absorption."†

Artificial respiration has been employed in some desperate cases with marked advantage, and even with complete success. A middle-aged man swallowed half an ounce of crude opium, and soon became lethargic. Emetics were given with considerable effect, but he was left too soon and fell into a state of complete lethargy, his pulse and respiration being nearly gone. Mr. Whately obtained a common bellows and distended his lungs; this in a few minutes produced a free expiration, and he gradually recovered.‡ Dr. Ogilvie, of Georgia, has published another successful case in a child ten days old, to whom

tine by the mouth, and in the form of enema, proved successful, is related by Dr. Jenkins. (New York Medical and Physical Journal, vol. iii. p. 303.) Dr. Fahnestock, in a case apparently hopeless, where the stomach-pump proved ineffectual, gave some sulphuric ether. This produced violent strangulating sensation, and aroused the action of the stomach and diaphragm; vomiting followed, and the patient was saved. (American Journal of Medical Sciences, vol. v. p. 250.)

* Cases in which venesection has been used with great success are mentioned by Mr. Richardson, Edinburgh Med. and Surgical Journal, vol. xvii. p. 226. By Mr. Ross, *ibid.*, vol. xix. p. 247. By Dr. Rush, in 1801, New York Medical Repository, vol. v. p. 124. By Dr. Akerly, *ibid.*, vol. xvi. p. 10. Dr. A. mentions a curious fact that occurred under his notice. A lunatic stole two ounces of laudanum, which were supersaturated with carbonate of potash, and swallowed them without any bad effects. By Dr. Young, American Journal of Medical Sciences, vol. xiii. p. 61. By Ollivier, of Angers, and Marye, Medico-Chirurgical Review, vol. viii. p. 270. By Dr. D'Outrepont, in a pregnant female, (from a German Journal.) American Journal of Medical Sciences, vol. v. p. 480.

† Christison, p. 644. Two cases came into St. Thomas' Hospital under similar circumstances. Both were females—the quantity taken by each was an ounce of laudanum, and suicide was intended by both. The stomach-pump was used in each case, but one was bled eight hours after taking the poison, and the other not at all. The remaining treatment was exactly alike. The one not bled recovered perfectly a day sooner than the other. Mr. Bullock, London Med. Gazette, vol. xix. p. 264.

‡ Medical Observations and Inquiries, vol. vi. p. 331.

twenty-five drops of laudanum were given.* But probably the most interesting is that related by Dr. Morris, as given below.†

In some instances, where all attempts to rouse the individual have proved unsuccessful, a succession of shocks with the galvanic battery, continued for several hours, has proved successful in continuing respiration, aided, however, by other means.‡

When the patient is in a hopeful way of recovery, purgative enemata are very useful, particularly if we have reason to believe that any of the opium still remains in the intestines. Frequent rubbing of the arms and legs, or sinapisms to the latter, are often also needed, in consequence of the torpor that has been induced.

The experiments of Orfila have demonstrated that the administration of vinegar, lemon-juice, or other vegetable acids, previous to the evacuation of the poison by vomiting, *will accelerate and aggravate the action of the opium*; but that, when the opium has been previously expelled, water acidulated

* North American Medical and Surgical Journal, vol. iii. p. 277.

† A mother, by accident, gave her infant, four months old, two drops of laudanum. The fluid was turbid, and, as was afterwards ascertained, contained fragments of opium. It escaped rapidly in droppings. In three hours, convulsions, with stertorous breathing, hot skin, and contracted pupils occurred. Sulphate of zinc was given and an enema of salt and water without any effect. Warm water was injected into the stomach, mustard cataplasms were applied to the feet and iced-water to the head. It was then placed in a warm mustard bath, but this last produced only one cry, the first and only token of sensation for several hours. The spasms increased. Dr. Morris now opened the mouth forcibly and made compression on the chest. After three minutes, a long sigh was drawn, and respiration re-established. Cloths heated very hot were now applied; a general redness, accompanied with violent convulsions, ensued. Artificial respiration was again resorted to, and by a continuance of these remedies, the child was left crying for drink just eleven hours after taking the poison. (Transactions of the College of Physicians, Philadelphia, No. 2, p. 30.) See also Howship and Smith, in Medico-Chirurgical Transactions, vol. xx. p. 86. Mr. Harrison, Lancet, N. S., vol. xxvii. p. 190. Dr. Ware, of Boston, has also related a case.

‡ Mr. Hensley, at the Middlesex Hospital, Lancet, N. S., vol. xxix. p. 88; Mr. Russell, London Medical Gazette, vol. xxxi. p. 924; Dr. Page, of Valparaiso, American Journal Med. Sciences, N. S., vol. v. p. 301; Dr. Marcy, Boston Medical and Surgical Journal, vol. xxviii. p. 426; Mr. Corfe, Lancet, January 27, 1844.

with vinegar or any other vegetable acid will tend to diminish and correct its effects. Coffee, when prepared in the form of strong decoction or infusion, rapidly lessens the symptoms, but cannot be considered as an antidote.* The only substance which he deems entitled to that name is a decoction of nut-galls. This throws down the active principles of an infusion of opium, and may consequently diminish its effects, previous to the necessary attempts for its removal.†

[When employed as physician to the New York City Prison, I had occasion to treat quite a number of cases of poisoning by opium, (suicidal.) In all, the persistent use of cold affusion upon the head was the chief, and in many the sole remedy. Eight or ten cases were thus saved, and I have no doubt that if this simple remedy were fairly tried we should hear of comparatively few fatal cases of poisoning by opium. Cold affusion and constant agitation are, in my judgment, worth all the other remedies put together, and it seems to me that a physician who neglects these simple and always available means for the more pretentious modes of treatment, assumes a very grave responsibility. The stomach-pump, if it can be had, should of course be used, and zinc may be given; but while these are preparing, affusion and constant agitation will pave the way for their successful use, even if they do not, as in my hands they generally have, supersede them altogether. —C. R. G.]

Hyoscyamus niger, L., (Black henbane.) Naturalized in the Northern States and in Canada. Several cases are on record

* Devergie, however, calls coffee an antidote to opium, and says he has recovered infants, apparently dying, by an injection of it. He earnestly advises its free and early use by the mouth, vol. ii. p. 814. Its value in a case of poisoning with acetate of morphine, may be seen in the London, Edinburgh, and Dublin Philosophical Magazine, April, 1847, p. 301. Böcker affirms that in cases in which there is a tendency to congestion of the brain, coffee operates injuriously. (Vergiftungen, 1857, p. 144.)

† O. Henry found pure tannin to be a minute test of morphine, throwing down an abundant white cheese-like precipitate. It acts similarly with strychnine and brucine, and will therefore be scarcely deemed a satisfactory reagent in detecting morphine in medico-legal cases. But his suggestion of tannin as an antidote, may deserve some attention. (Philadelphia Journal of Pharmacy, vol. vii. p. 235.)

of the baneful effects of this plant. Wepfer mentions that several monks made a repast on the roots of wild endive, among which were mixed by mistake two roots of henbane. In a few hours, some experienced vertigo; others, a burning of the tongue, lips, and throat. Severe pains were also felt in the iliac region, and in all the joints. The intellectual faculties and organs of vision were perverted, and they gave themselves up to actions that were mad and ridiculous; they, however, recovered. In other cases, a haggard countenance, dilatation of the pupils, difficult breathings, small and intermittent pulse, loss of speech, trismus, and temporary loss of intellect, have been the principal symptoms, while the extremities have been observed cold and nearly paralyzed. A clyster, prepared of a decoction of henbane, caused a numbness and loss of motion of the upper and lower extremities, propensity to sleep, and difficulty of hearing.*

Dr. Patouillat, of Toucy, in France, saw nine persons poisoned with this root. Some were speechless and convulsed; others occasionally howled; in all these was a protrusion of the eyes, contortion of the mouth, and delirium. Emetics relieved them, but their sight was for some days affected, and all objects appeared red like scarlet.†

The vapors of this plant, and of belladonna, are said to have been lately used by Hufeland in nervous affections. When exposed to these, even although precautions were taken to prevent the fumes from reaching the face, profuse perspiration

* Orfila's Toxicology, vol. ii. p. 135; Foderé, vol. iv. 25.

† Philosophical Transactions, vol. xl. p. 446. See also additional cases by Dr. Stedman, in *ibid.*, vol. xlvii. p. 184; by Sir Hans Sloane, *ibid.*, vol. xxxviii. p. 99; Choquet and Wilmer, quoted in Christison, p. 648; by Mr. Donaldson, *Medico-Chirurgical Review*, vol. x. p. 242. Case by Dr. Burdach, from eating the capsules. (*Monthly Journal of Medico-Chirurgical Knowledge*, vol. i. p. 58.)

Edinburgh Medical and Surgical Journal, vol. lxii. p. 562, (from *Encyclop. des Sciences Médicales*, March, 1844.) Nine persons partook of a soup prepared with its roots, by mistake for parsnips. They soon began to feel an acrid taste; the pupils dilated, with loss of sight, and convulsions and delirium soon followed; stupor and somnolency succeeded: but they were all relieved by emetics and a stimulant plan of treatment.

ensued, with a sense of fullness in the head, and sometimes tremors, difficult respiration, and vertigo.*

On animals the juice and decoction of the root produced lethargic effects, but very seldom any giddiness or convulsions. When applied to the cellular texture, death ensues sooner, and vomiting occurred in one case, but generally the comatose symptoms were all that were observed. No inflammation was noticed in the stomach; the lungs were occasionally livid, and black blood was observed in the heart.†

Lemon-juice has been announced by Dr. Medoro as a successful antidote in cases of poisoning by hyoscyamus. He relates four instances in which the common effects of the poison were produced by various quantities, as three, nine, and thirteen grains of the extract. In all, these symptoms were rapidly mitigated and relieved by the use of the lemon-juice.‡

Hyoscyamus albus, L. (White henbane.) The following case is an example of its effects: In April, 1792, a large quantity was carried by mistake on board the French corvette *La Sardine*, which the sailors had gathered in one of the isles of Sapienza, in the Morea, where the vessel then was. A part of it was put into the ship's copper, and the remainder into those of some of the subaltern officers. At four o'clock they all dined. In a short time, vertigo, vomiting, convulsions, gripes, and purging were generally experienced; and when Dr. Picard, the surgeon, came on board, he observed the gunner making a thousand grimaces and contortions. By keeping up the evacuations, most of them recovered; but those in whom there were none, remained for some time in a sickly condition.§

The *Hyoscyamus aureus*, L., *physaloides*, L., and *scopolia*, L., are also deemed poisonous.

Geiger and Hesse have obtained an alkaloid from the *H. niger*, and which is called *hyoscyamine*—that formerly an-

* Henbane, when drying by heat, induces in those who inhale its odor, a disposition to quarreling and fighting. (Sigmond, in *Lancet*, vol. xix. p. 123.)

† For experiments with the alkaloid *hyoscianina*, see *British and Foreign Med. Review*, vol. xix. p. 260.

‡ *Edinburgh Medical and Surgical Journal*, vol. lv. p. 266.

§ *Foderé*, vol. iv. p. 23. There is also a case by Dr. Hamilton, in *Edinburgh Physical and Literary Essays*, vol. ii. p. 268.

nounced by Brande being now considered impure. Dr. Morries has also obtained from it, by distillation, an empyreumatic oil of great activity.

The vapor of the impure alkaloid discovered by Meissner and Brande was found to be very injurious to the eyes; and the most minute fragments, placed on the tongue, proved deleterious.*

Solanum dulcamara, L. (Woody nightshade, Bittersweet.) A native of the United States. This, and other species of the same genus, (*Solanum nigrum*, *villosum*, *fuscatum*, etc.,) were deemed narcotic poisons until the experiments of Orfila and Dunal threw some doubt on their activity. Dunal found that a dog might take 180 of the berries of *Solanum dulcamara*, or four ounces of the extract, without inconvenience; and quotes an experiment where thirty-two drachms of the extract were taken by a person, in two cases, without injury.† Mr. Burnett, in the first volume of the Medical Botany, gives cases communicated by Mr. Wheeler, of Bayswater, showing the actual poisonous effects of the berries of this plant. Several children, from eating them, were seized with violent pain in the intestines, vomiting and purging, and in one instance, a profuse secretion of saliva. They required active remedies to relieve them. Mr. Wheeler adds that he has known of two fatal cases from their use.

Again, three children were poisoned with the berries of the *Solanum nigrum*, in 1838, near Nantes, one of whom died in convulsions. And Dr. Hirtz, of Colmar, gives the history of two boys, three years old, in whom were present extreme dilatation of the pupils, trismus, and general convulsions, violent screamings, red spots over the whole of the body, burning heat, and small and very frequent pulse. With all these, the mind was lost, and the patients would only now and then articulate a few words, like persons intoxicated. No vomiting or

* Tilloch, vol. lvii. p. 308; Brande's Journal, vol. xi. p. 205. For Geiger's late experiments, see Philadelphia Journal of Pharmacy, vol. vi. p. 318.

† Christison, third edition, p. 682. In the second edition of Dr. Smith's Forensic Medicine, p. 187, is a case of poisoning by the extract, quoted from Hufeland's Journal. The individual took an ounce of it. It produced vertigo, palsy of the tongue, and cold sweats. It did not prove fatal.

purgings was present. Repeated emetics produced no effect; but recollecting that calomel, when given to children, frequently induces vomiting, he ordered it in repeated doses with success. Milk was then prescribed, with a warm bath, and these were followed by acetate of ammonia. In some eight or ten hours, after several stools, the urgent symptoms disappeared, and a quiet sleep came on, which ended in perfect recovery.*

Desfosses obtained an alkaloid from these plants, termed *solanine*, and which produced narcotic effects.

Doubts have lately been thrown on its existence;† but the recent experiments of Otto, who even found it in the potato, (*solanum tuberosum*,) would seem to decide the question. One grain of this was sufficient to kill a rabbit in six hours.‡

Still later, Baumann has repeated these experiments with similar results. Solanine exists in the potato, (most in the germs, less in the stalks and leaves, and least of all in the tubercles,) and in all the solanaceæ. Boiling partially eliminates it from the potato. It is energetic in small doses, but less so than other alkaloids.§

Lactuca virosa, L. (Strong-scented lettuce.) The extract of this plant, in large doses, produces effects similar to those of opium, but a longer period is required to develop them. It acts with more rapidity when applied to the cellular texture, or injected into the veins.

The lettuce opium, or extract of the *Lactuca sativa*, is much weaker.

Taxus baccata, L. (Yew.) Great diversity of opinion has existed concerning the properties of this plant. Orfila, however, deems it a narcotic.

Dr. Percival relates that the fresh leaves were administered

* Encyclographie des Sciences Médicales, fourth series, vol. i. p. 272; vol. xii. p. 417. In the last, the fact of eating the berries was proved by their companion, seven years of age.

A fatal case proceeding from the berries of the woody nightshade, is given in the Lancet, June, 1856.

† Magendie, quoted in London Med. Quarterly Review, vol. iv. p. 311.

‡ Lancet, N. S., vol. xiv. p. 117; Journal de Pharmacie, vol. xxv. p. 653.

§ Chemist, vol. v. p. 334.

to three children of five, four, and three years of age, near Manchester, for worms. Yawning and listlessness soon succeeded, and the oldest vomited a little, and complained of pain in the abdomen; but the others expressed no sign of pain. They all died within a few hours of each other.*

A fatal case occurred in a child, three and a half years old, in England, in 1836. It vomited while at dinner, and brought up with its food some portions of the berries; convulsions followed, and it died in two hours after. On dissection, portions of the berries were found in the stomach, which had red spots on its surface, and its mucous membrane was greatly softened. The lungs were of a florid red; the blood-vessels of the brain filled with dark-colored blood; and the anterior part of the surface of the body, the legs, abdomen, and breast, covered with purple spots or patches.

Mr. Hurt, the reporter, supposes the poison to reside in the seed only. When this is swallowed, it may, he thinks, pass through the intestinal canal unaltered, but when the husk of the seed is broken and exposed to the gastric juice, it is then liable to cause poisonous effects.†

Paris quadrifolia, L., (Herb Paris, One-berry, True-love,) occasions vomitings and spasms. The root of *P. pollyphylla* (Smith) is also said to be highly poisonous.‡

Actæa spicata, L., (Herb Christopher, Bane-berries.) A native of the United States. The berries of this plant are noxious, according to the testimony of Linnæus, Colden, and

* Medical Commentaries, vol. vi. p. 33. It is also mentioned that a drove of cattle (twelve in number) were poisoned in December, 1814, in Montgomeryshire, Wales, from eating the branches of this tree. (Edinburgh Annual Register, vol. vii. p. 162.) Two cases of death, from its leaves and berries, are given by Metzger, p. 397. Mr. Tatem, in Loudon's Magazine of Natural History, vol. viii. p. 91, mentions that two horses were put under a yew-tree, which they cropped with eagerness. No unfavorable circumstances appeared for three hours, when, having staggered a few paces, they both dropped, and before the harness could be taken off, they were dead. Their stomachs were contracted and inflamed.

† Lancet, N. S., vol. xix. p. 394. The investigations of MM. Chevallier, Duchesne, and Reynal, respecting the poisonous properties of yew leaves, are recorded in Annales d'Hygiène, 1855, vol. ii.

‡ Edinburgh Philosophical Journal, vol. i. p. 380.

Le Monnier. It is poisonous to cattle, but sheep and goats eat it.*

Physalis somnifera, L., *Azalea pontica*, L., *Peganum harmala*, L., are deemed narcotics. I have already spoken of the second as producing poisonous honey.

PRUSSIC ACID, (*hydrocyanic acid*.)

This substance, in its concentrated state, is one of the most energetic of poisons, and its virulence varies with its strength.

The pure acid is liquid, limpid, and colorless. It has an acrid, pungent taste, and a very peculiar odor, which, when diffused through the air, has a distant resemblance to that of bitter almonds. It is an error, however, says Dr. Christison, to suppose that its *odor is the same with that of the almond*.† At ordinary temperatures, it decomposes spontaneously within a few hours.

It is, therefore, the acid diluted with water that is the article to be found in the apothecary's shop; and there is, unfortunately, much variety as to its strength, depending on the various processes by which it is made, and the tendency which it also has to decomposition. The medicinal acids on the Continent, either alcoholic or watery, vary from one to fifty per cent.; and this circumstance will explain the many cases of poisoning that have occurred there. If made according to Vauquelin's method, and which is in common use in England, the percentage will be 3·3.‡ But even there the medicinal preparations differ "frightfully."§

Effects on man. The following case is related on the authority of Hufeland, as an example of its effects: A man,

* *Actæa spicata*, Mich., includes the *Actæa rubra*, Wild, and *A. alba*, Big., which are decidedly distinct. The fruit of both, as well as of *A. racemosa*, L., are noxious.

† Dr. A. T. Thomson confirms this. (Cyclopedia of Practical Medicine, vol. iii. p. 723)

‡ Christison, p. 753.

§ Everitt, in London and Edinburgh Philosophical Magazine, vol. vi. p. 101. He produced samples from different druggists in London, (Apothecaries' Hall included,) and found them to vary from five-eighths per cent. to one-fourth per cent.; and this, though he asked in each for Scheele's acid.

about to be taken up as a thief, swallowed an ounce at 2 P. M. He staggered a few steps, and fell. The pulse could not be felt, and there was no trace of breathing. In a few minutes, a single and violent expiration took place. The extremities were cold; the eyes half open and shining, but without any irritability. At night he was stiff. The blood, on dissection, had the smell of bitter almonds. The pia mater and vessels of the brain were filled with blood. The stomach was highly inflamed, and presented gangrenous spots of the size of a sixpence. The villous coat separated on the slightest pressure of the nails. The intestines were healthy; the liver natural, but filled with black blood. All the blood was collected in the veins, while the arteries were empty, and it was generally of a black-blue color, fluid, yet thick like oil, and had a most penetrating smell of bitter almonds.*

Orfila also relates the following, as communicated to him by M. Fueter: "M. B., professor of chemistry, left, through forgetfulness, a flask, containing alcohol saturated with prussic acid. The servant-girl, seduced by the agreeable smell of the liquor, swallowed a small glass of it. At the expiration of two minutes she fell dead, as if she had been struck with apoplexy. The body was not opened."†

Dr. B., of Rennes, took two teaspoonsful of the acid, (prepared by Vauquelin's process.) In a few seconds he fell; his teeth were closed; the respiration was difficult, noisy, and rattling; the mouth distorted; the extremities cold; the pulse scarcely perceptible; the face and neck red and swelled; the pupils fixed and dilated; and, in a word, all the appearances of apoplexy were present. A violent convulsion followed.

* London Medical Repository, vol. iv. p. 506. The appearance in the stomach, which Hufeland styles gangrenous, is with great probability considered by Dr. Geoghegan, of Dublin, to have been a dark-red extravasation under the mucous coat. He visited a person who had swallowed an ounce of the medicinal acid, and who died in consequence. The only morbid appearance was the above dark-colored extravasation. The stomach exhaled the peculiar odor for three days, at the end of which time the presence of the poison was detected by the usual means. (From the Dublin Medical Journal, November, 1835. *Lancet*, N. S., vol. xvii. p. 174.)

† Orfila's Toxicology, vol. ii. p. 147. The professor, I believe, was Magendie.

Antidotes were administered, and after some time, there was a slight vomiting, but he did not recover his senses until nearly three hours had elapsed. Dyspnœa continued, but with enemas and other applications he gradually recovered. After every evacuation by stool, a quantity of gas was discharged from his mouth, which had the odor of prussic acid. It was a fortnight before he perfectly recovered.*

Mr. Ferrus was in the habit of using the acid prepared according to Magendie's formula, viz.: 1 part of acid to 128 of syrup. He directed half an ounce to be administered to fourteen epileptics at the Bicêtre. Instead of using this, the attendants obtained some which had been prepared according to the French Pharmacopœia, (one part of acid to one of syrup.) By the time the medicine had been administered to the seventh, the first was dead, and the others expired within forty-five minutes.† The symptoms in all were first convulsions and then coma.

The inspiration of this substance, when diffused in the state of vapor through his laboratory, caused in Dr. Ittner oppression and painful respiration, giddiness, vertigo, and burning heat.‡

Dr. Heller gives the case of a chemist in Paris, who applied a bottle of Scheele's acid to his nose. He was soon seized with extreme tightness of the chest and tetanic stiffness of the whole body. His legs in particular were immovable. The vapors of ether and ammonia were applied to his nose with some success; but the circulation remained extremely low, not rising

* London Medical Repository, vol. xxiii. p. 233.

† Medico-Chirurgical Review, vol. xiii. p. 461. Other cases are mentioned by Hufeland, Quarterly Journal of Foreign Medicine and Surgery, vol. v. p. 467; Mertzdorff, Edinburgh Med. and Surgical Journal, vol. xxii. p. 232; Dr. Whiting, Lancet, N. S., vol. vi. p. 250; Leuret, Annales d'Hygiène, vol. iv. p. 422. Case of Mrs. Latten, dead in twelve minutes from taking by mistake a drachm and a half of the acid, Lancet, N. S., vol. xii. p. 257. A case said to have occurred near Leeds, in England, Annales d'Hygiène, vol. x. p. 180; Christison, p. 664, etc.

‡ American Medical Recorder, vol. ii. p. 530. See also the effects produced on Professor Silliman, from breaking a bottle in his laboratory. (Silliman's Journal, vol. ii. p. 93.)

for some time above forty. The distress continued during the day, but he gradually recovered.*

When the effects produced by a dose are not too rapid, and opportunity is given for observing them, the earliest appear to be giddiness, with a loss of muscular power and control over the combined action of the muscles, the head droops, the mouth is open, the tongue protrudes, and there is apparently a sense of distress and constriction in the fauces. The muscles of the pharynx and larynx are early and powerfully affected. Mr. Nunneley remarks that, at this period, persons who can, and who cannot, detect the presence of the acid by the sense of smell, are both at once conscious of it by a peculiar feeling of dryness and a sensation of constriction in the throat, which sometimes remains for a number of hours.

The unsteadiness and loss of power is speedily succeeded by spasms—more or less severe, according to the strength of the dose. The heart is proportionably affected. It ceases to pulsate, and respiration is equally prevented. Hence the lividity and bloatedness of the face, the protrusion of the eyes, and the excessive congestion of the veins. But from smaller quantities the rigidity will abate and be succeeded by paralysis more or less complete, respiration is performed by sighing, and the heart beats rapidly and feebly.

Alternate states of convulsions and paralysis may continue, and end in death—or diminish in severity, so as to promise a recovery.†

It is altogether a mistake that the person poisoned always utters a shriek or scream immediately before death. This was much talked about during the famous trial of Tawell for poisoning his mistress, but so many cases have, of late years, been

* London Medical and Physical Journal, vol. lii. p. 63.

† I have taken this list of symptoms from the abstract of Mr. Nunneley's experiments on the effects of hydrocyanic acid upon animal life, in Edinburgh Medical and Surgical Journal, vol. lxxiii. p. 132. Other extracts are given under the head of Effects on Animals. In Dr. Lonsdale's Experimental Inquiry, published some years ago, and hereafter referred to, he also insists much on attention to what he deems an important diagnostic symptom, "the exhalation by the breath of the acid vapor of the poison." I infer that this is identical with the cause of the effects on the throat mentioned by Mr. Nunneley.

witnessed during the last moments from poisoning by the acid, and in which it did not occur, that it is now discredited by several writers.

It is not necessary after this to caution the physician in his administration of this highly powerful agent.*

There are two questions which may be asked in medico-legal trials which the physician should be prepared to answer. They are judiciously considered by Dr. Christison. *Within what time may hydrocyanic acid prove fatal, and how long is it before it begins to operate?*

Now very large doses, as we have seen, cause death in a few seconds; but, generally speaking, the cases that require examination have not been produced thus. It is the ordinary medicinal acid, at various degrees of strength, that is the agent.

As to the first, it is supposed by Christison, on the researches of Schubarth, that if an individual survive forty minutes, he will generally recover. Dr. Lonsdale supposes it probable if he survives fifteen minutes.

The last question came up for consideration on a trial in England. An apothecary's maid-servant at Leicester, who was pregnant by her master's apprentice, was found one morning dead in bed, and obviously poisoned by hydrocyanic acid. The body was in a composed posture, with the arms crossed over the trunk, and the bedclothes pulled closely up to the chin; and at her right side lay a small narrow-necked phial, from which about five drachms of the acid had been taken, and which was corked and wrapped in paper.

The question arose, whether all these acts could be per-

* The following articles deserve perusal on this point—on the deleterious effects of the hydrocyanic acid, by Dr. Randolph, of Philadelphia. (American Med. Recorder, vol. iv. p. 456. Review of Granville's Treatise on Prussic Acid. Ibid., vol. iv. p. 562.)

There is, however, one point to which I may briefly advert. It is, whether prussic acid, given medicinally, causes ptyalism. This is asserted by Drs. Elliotson, Granville, and Macleod to have occurred in some cases. (Christison, p. 663; London Medical and Physical Journal, vol. xlix. p. 128.) They are not, however, numerous. By others this occurrence is attributed to the cyanide of mercury from which it is prepared; but not with much probability.

formed by the deceased before becoming insensible. To settle this point, Mr. Macaulay, Mr. Paget, and other medical men of Leicester, experimented on animals, and the result was unfavorable to the supposition, since one dog was killed with four drachms in eight seconds, and others in even less time. Dr. Christison, although inclining generally in favor of the opinion deducible from these, supposes it possible that occasionally the acid may not act with such extreme rapidity.

The principal circumstantial testimony in favor of the prisoner was, that he must have passed through three doors without noise, and one occupied room, in order to arrive at the apartment of the deceased.*

In a case quoted by Dr. Christison, the bedclothes had been drawn up as high as the breast, and the right arm extended down beneath the clothes. In another, a person swallowing some acid by mistake, called out for hartshorn, and was found reclining on the steps of the cellar where he had been sent. With the cry for aid, however, he expired.

The smallest dose that has proved fatal is that given to the Parisian epileptics. Each of them took twenty grains of the medicinal acid, which quantity ought to have contained only two-thirds of a grain of pure acid.†

Appearances on dissection. In addition to Hufeland's case, already given, I may mention the following:—

In the persons poisoned at the Parisian Hospital, the back part of the body was livid; the head, face, and lips bloated, and of a violet color; frothy blood issued from the mouth and nose; the eyes were closed and the body rigid. The cellular tissue of the stomach and small intestines was highly injected, and in one place dark: but there was no odor of hydrocyanic acid from the stomach. Its inner membrane had red patches. So also in the small intestines, and at the point corresponding with the external blackness, there was blood effused between the mucous and muscular coats. The liver, spleen, and kidneys were healthy, but highly gorged with black blood. The

* Christison, p. 666; London Medical Gazette, vol. viii. p. 580. Trial of Freeman for the murder of Judith Burwell, April, 1829.

† Orfila, quoted by Christison, p. 669.

heart was healthy, but contained no blood. The great arteries were empty, but the great veins gorged with black fluid blood. The lungs were slightly gorged, and the windpipe was of a deep red, and its ramifications filled with a bloody froth. The sinuses and veins of the brain were filled with fluid blood, but there was no effusion. The brain was soft.*

In a case that occurred to Mr. Crisp, and examined seventy hours after death, bloody serum flowed from the mouth. The skin, except on the depending parts, was tinged with a violet color. The cutaneous veins of the left arm were distended with blood of a purple color, and crimson spots and streaks were also seen on various parts of the body. All the viscera were healthy, except their color, owing to the purple and bluish state of the blood. The heart was flabby and empty, and no odor could be detected. The coronary vein of the stomach was distended with air to the size of a goose quill.

In this case it seemed *probable* that the suicide, after swallowing the poison, had thrown the bottle in a *pot de chambre* and pushed it some distance under the bed.†

In other instances the odor of bitter almonds had been very perceptible. It is mentioned by Leuret and Hufeland. Schubarth observed it distinctly in the blood, heart, lungs, and cavities of the brain for several hours after death, provided the animal died within from four to ten minutes. If life was prolonged, or the dose was so small as not to cause immediate dissolution, he could not discover the odor. Dr. Lonsdale, however, found it preserved in no less than fifteen experiments on animals, as late as the eighth or ninth day after death, even where life was prolonged to the eighth minute.

Rigidity of the limbs is also of slow occurrence. In Mertzdorff's case there was an erection and marks of an emission of semen, and the blood was violet colored, but there was no odor. In other respects, the examination corresponded with those already given.‡

* Orfila, *Annales d'Hygiène*, vol. i. p. 507; *Edinburgh Medical and Surgical Journal*, vol. xxxiii. p. 221. The dissections were made by Adelon, Marc, and Marjolin.

† *Lancet*, September 14, 1844, vol. i. p. 751.

‡ Leuret, *Annales d'Hygiène*, vol. iv. p. 422; Mertzdorff, *Edinburgh Med.*

Effects on animals. Two drops of the acid, prepared according to the process of Scheele, and which consequently contained considerable water, caused a bitch to stagger, fall, and vomit. Eight drops induced weakness, plaintive cries, purging, falling down, tetanic stiffness, dilatation of the pupils, paralysis, insensibility, and at length sleep. "In fifteen minutes the animal rose up, passed some urine, experienced an opisthotonos, and in half an hour was recovered." Thirty or forty drops destroy dogs and cats in six, twelve, or fifteen minutes after taking them, and the blood is all found in the veins, the arteries being empty, while the muscles are pale. Convulsions generally attend the administration of this poison.

Animals of various classes equally sink under its effects; a carp which was made to swallow twenty-four drops; snails, leeches, crabs, lobsters, bees, ants, and grasshoppers. A cow, according to Emmert, died with all the phenomena of opisthotonos, a few seconds after injecting half a drachm into the trachea.*

M. Robert exposed animals to the aperture of a matrass in which prussic acid had been distilled, and the air of which consequently was a mixture of the atmospheric fluid with the vapor of this acid. Birds, rabbits, cats, and dogs all died in a short space of time—from an instant to six minutes. The liquid acid in its pure state, and also dissolved in alcohol, was equally, but not so promptly destructive. He examined a dog destroyed by it. The brain was healthy, but exhaled the odor of prussic acid. The tongue was soft, bluish, and hung out of the mouth. The mucous membrane of the trachea was injected. The lungs were of a bright-red hue, and the heart was filled with very dirty deep-red blood. The veins contained thick and

and Surgical Journal, vol. xxii. p. 232. Schubarth explains the presence or absence of the odor, (on which he has made numerous researches,) by stating that if the dose be sufficient to cause death in ten minutes, the peculiar odor will always be remarked in the heart, lungs, and great vessels, provided the body has not been exposed to rain or a current of air, and is early examined; but if life be prolonged from ten to thirty minutes, or under circumstances opposite to those just named, the odor may not be noticed, since the acid is rapidly discharged by the lungs, or it may be decomposed. (Christison, p. 671.)

* Orfila's Toxicology, vol. ii. pp. 142 to 146.

dark-colored blood. The lungs and heart and their contents exhaled the odor of prussic acid.*

Mr. Nunneley performed upwards of one hundred and fifty experiments on animals, the most of which were dogs. On dissection, the liver was observed to be soft, the spleen natural, the stomach much contracted and its mucous membrane red, the lungs not engorged, but appeared shrunken and contracted; the heart distended on both sides, and the blood equally dark in each. The blood was darker, generally, than natural, and of a muddy appearance. In the greater number of cases it coagulated, but less dense than is usual, and the process was somewhat delayed. The odor was very manifest in the breath for a short time, but soon passed off. In almost one-third of the cases, of the animals poisoned (dogs, rabbits, mice, and cats), there was a "cry of so peculiar a kind and so indicative of severe distress, as to give the idea of consciousness on its part of impending death."

It is hardly necessary to add that the concentrated acid acts with the rapidity of lightning. I subjoin some references to additional experiments.†

Tests. These have been particularly examined by Lassaigne, of Paris, Professor Turner, of London, and Professor Orfila.‡

* London Med. Repository, vol. iii. p. 243.

† Essays on Prussic Acid, by Duvignau and Parent. (American Medical Recorder, vol. ii. p. 573.) Experiments by Dr. Davie, Eclectic Repertory, vol. x. p. 246. A few drops thrown on the eye of a cat caused death. (Annals of Philosophy, vol. xii. p. 23.) It is here stated that Magendie dipped a rod into the acid prepared according to Gay-Lussac's method, and brought it in contact with the tongue of an animal. Death ensued before the rod could be withdrawn. (Gay-Lussac's Essay on Prussic Acid, in the Annals, vols. vii. and viii.; and Magendie's, in Brande's Journal, vol. iv. p. 347.) Krimer's Expedition, in Bulletin des Sciences Médicales, vol. xiii. p. 124; Orfila, Annales d'Hygiène, vol. i. p. 504. Magendie on its external application. (Lancet, N. S., vol. xv. p. 146.) Christison's experiments, Treatise on Poisons, p. 657. He noticed tetanus as a frequent occurrence. Garret and Hastings's experiments, in Midland Medical and Surgical Reporter, vol. ii. pp. 317, 319. Dr. Lonsdale's Experimental Inquiry, Edinburgh Medical and Surgical Journal, vol. li. p. 39. Mr. Nunneley's Experimental Inquiry, abstracted from the Transactions of the Provincial Med. and Surg. Association, 1847, with two cases in Edinburgh Medical and Surgical Journal, vol. lxxiii. pp. 132, 243.

‡ Lassaigne, Brande's Journal, vol. xviii. p. 397. He proposed the tests

I subjoin those proposed by them, with one recently presented by Professor Liebig.

(a.) *The peculiar odor.* On this I have already remarked. It is asserted by Orfila, but doubted by Christison, that the smell is perceptible when no chemical agent is delicate enough to detect the acid. Its occasional absence is also an objection to a too great dependence on it.

(b.) *Sulphate of copper* forms with hydrocyanic acid, when rendered alkaline with a little potash, a greenish precipitate, which becomes nearly white on the addition of a little hydrochloric (muriatic) acid. The last acid redissolves some *oxide* of copper thrown down by the potash, and the precipitate is then the cyanuret of copper. Lassaigne observes that this test will act on the poison when dissolved in 20,000 parts of water.

(c.) *The salts of the protoxide of iron*, if the acid be rendered alkaline by potash, produce a grayish-green precipitate, which on the addition of a little sulphuric acid, becomes of a deep *Prussian blue* color. The common green vitriol* will answer for this purpose, and even the salts of peroxide of iron may be used, since they are, unless very carefully prepared, never altogether free of the *protoxide*. But it is shown by Turner, in opposition to Lassaigne and others, that the salts of the pure peroxide have no such effect. They cause, with the potash, a brownish precipitate, which is redissolved on the addition of sulphuric acid, leaving the solution limpid. Dr. Turner also deems this test more delicate than the former one.†

The same test is applicable to the detection of the vapors of hydrocyanic acid. Invert a watch-glass, moistened with a few

of sulphate of copper and nitrate of silver, and I rather imagine that Dr. Granville first proposed the sulphate of iron. London Medical Gazette, vol. ii. p. 651; Turner, Edinburgh Medical and Surgical Journal, vol. xxx. p. 344; Orfila, Lancet, N. S., vol. iv. p. 737; Annales d'Hygiène, vol. i. p. 489.

* Protosulphate of iron, copperas.

† It is very important to understand the distinction taken by Dr. Turner. "The formation of Prussian blue," he remarks, "from prussic acid, by admixture with a salt of iron and potash, does not occur when the iron is strictly at its maximum of oxidation. A very minute quantity of the protoxide, however, gives rise to the production of Prussian blue, which is rendered obvious by dissolving the precipitated oxide by a slight excess of sulphuric acid." (Edinburgh Journal of Science, N. S., vol. ii. p. 217.)

drops of solution of potash, over the vessel containing the suspected fluid. After a few minutes a drop of a solution of commercial sulphate of iron may be added to the potash, and then a drop of diluted muriatic acid. Prussian blue will make its appearance if hydrocyanic acid be present.

(d.) *Nitrate of silver* gives a *white* precipitate, with a diluted solution of acid, and this precipitate (cyanuret of silver) is distinguished from the other white salts of silver by being insoluble in nitric acid at ordinary temperatures, but easily soluble in it at its boiling temperature. On adding a little muriatic acid to the precipitate, hydrocyanic acid is evolved. The precipitate, also, when thoroughly dried and heated in a small reduction tube, emits cyanogen, which is known by its beautiful flame.*

(e.) *Sulphur test.* When some hydrosulphuret of ammonia and caustic ammonia are added to an aqueous solution of prussic acid, and the mixture heated with the addition of a little pure flower of sulphur, sulphocyanide of ammonia is soon formed. This may be evaporated after solution in alcohol, and pure colorless crystals of the last compound will be obtained. On adding, as has been stated under the head of opium, a solution of a persalt of iron, an intense blood-red color will be produced, and which color again disappears on adding one or two drops of a solution of corrosive sublimate.

This test was proposed by Liebig, and is deemed a very minute one, applicable to prussic acid in a state of vapor.†

Orfila recommends, as the best method for ascertaining the *strength* of a solution of hydrocyanic acid, to throw down the

* Mr. Barry also adds that the cyanuret of silver may be further verified by its redissolving when a drop of caustic ammonia is applied. (London and Edinburgh Philosophical Magazine, vol. iv. p. 152.)

“Mr. Everitt showed a very delicate test at the Medico-Botanical Society. Place over a watch-glass containing the smallest quantity of prussic acid, alone or mixed with some other body, another piece of glass damped with a solution of nitrate of silver. The prussic acid being extremely volatile, escapes, and coming in contact with the nitrate, renders the glass opake by forming cyanuret of silver.” (Lancet, N. S., vol. xix. p. 754.)

† London, Edinburgh, and Dublin Philosophical Magazine, vol. xxxi. p. 146; Taylor's Medical Jurisprudence, by Griffith, p. 160.

nitrate of silver, and dry the precipitate; a hundred parts of this will correspond to 20.33 of the pure acid.

As to the detection of this poison *when mixed with animal matters*, Leuret and Lassaigne have made some researches. They found that if the body of an animal poisoned with this acid is unburied for three days, the poison can no longer be detected; but that if it is buried within twenty-four hours, the poison may be found after a long interval, but never after eight days. The reason of this has already been intimated.* In one case the poison was detected seventeen days after death.†

For the detection of the acid in these instances, Orfila advises that a piece of writing-paper, moistened with caustic potash, be dipped in the mixed fluids. This paper should then be touched with a solution of the sulphate of iron; and if hydrocyanic acid is present, the usual blue color, with a tinge of green, will appear, and this will become more blue by exposure. Purified animal charcoal alone, without heat, will sometimes destroy the color of the fluid, and permit it to be tested by the reagents already enumerated.‡

If neither of these modes is found to answer, the fluid may be placed in a wide-mouth phial, which can readily be covered by a watch-glass, and of such capacity that the contents will reach within an inch or two of the top. A drop or two of the test having been previously placed over the watch-glass, it is inverted over the phial; if prussic acid be present, the characteristic reactions will show themselves in the course of a few minutes. The contents of the phial may then be distilled. Dr. Christison recommends that the filtered contents be previously neutralized with sulphuric acid, if they are alkaline, so as to fix the ammonia which may have been disengaged by putrefaction; and then distill the product slowly from a vapor bath.

* Christison, Brande's Journal, N. S., vol. i. p. 480. It is possible, however, that the poison may be detected somewhat later, as the iron test, in the form proposed by Turner, was not used by them. A case in which Lassaigne could not succeed in detecting the poison after thirty-eight hours, is given by Leuret, in *Annales d'Hygiène*, vol. iv. p. 422.

† See Taylor, 2d Am. ed., p. 596.

‡ *Annales d'Hygiène*, vol. i. p. 493; *Lancet*, N. S., vol. vii. p. 806.

till an eighth part has passed over it into the receiver. The distilled fluid should then be tested with the protosulphate of iron, or the sulphuret of ammonia.

It has been objected to this last process, that hydrocyanic acid may be formed during the distillation, by the decomposition of animal matter. Undoubtedly, in some instances, it appears to have been thus generated; but in the present state of our knowledge, all that can be done to avoid this occurrence is, not to press the heat of the vapor bath too much.

The application of the tests has already been made in medico-legal cases. In the instance of Ramus, the particulars of whose murder are mentioned at page 142 of this volume, the facts ascertained led to the suspicion that he had not been able to offer any resistance; and it was hence suggested that prussic acid might have been previously given.

At the end of seven days, when the examination was made, the matters found in the stomach had a sharp odor, "*ayant quelque chose de vineux.*" They were also distinctly acid; and on distillation, the smell resembled *that of bitter almonds*. The tests above recommended were now applied. Nitrate of silver gave a curdled white precipitate, which, when treated with nitric acid and the application of heat, dissolved nearly altogether. Sulphate of copper produced a minute milky precipitate. It was evident, from these circumstances, that hydrocyanic acid was present in the stomach in minute quantities, and the probability was great that the murdered person had taken it. The only doubt was, whether it might not have been generated from the matters contained in the stomach.*

Antidotes. I fear we must assent to the remark of Mr. Nunneley, that we "know of no antidote." Still there are some powerful stimuli which have proved of service.

Ammonia was first recommended by Mr. John Murray, of London.† He administered fatal doses of the acid to animals,

* *Annales d'Hygiène*, vol. ix. pp. 363 to 379. The case is reported by Chevallier and Boys, de Loury. Some acid was found in a phial in the room of the murderer.

The alleged spontaneous production of prussic acid is discussed by Taylor. (*Poisons*, p. 598.)

† *Edinburgh Journal of Science*, vol. ii. p. 214.

and immediately thereafter applied ammonia to their nostrils; they invariably recovered. Dupuy confirmed these results by experiments on horses;* and the general course of observation, with some fluctuations, goes strongly to show its efficacy. In the latest publication of Orfila, he speaks highly of the application of the vapor, and states that he has thus recovered several dogs; but he, as also Dr. Herbst, attach little value to swallowing the liquid ammonia.† It should be remembered that ammonia is often extremely acrid, and may cause inflammation of the mouth and throat. Hydrocyanate of ammonia has also been found to be poisonous.

Chlorine. This was first proposed in 1822, by Riauz, a chemist of Ulm, and many experiments on animals have verified its value. "According to Orfila, animals which have taken a dose of poison sufficient to kill them in fifteen or eighteen minutes, will be saved by inspiring water impregnated with a fourth part of its volume of chlorine, even although the application of the remedy be delayed till the poison has operated for four or five minutes."‡

If chlorine be not immediately attainable, a solution of the chloride of soda, to which a little muriatic acid has been added, may be given, and in case the patient cannot swallow, a handkerchief should be dipped in the solution and applied to the nose.§

* London Medical Repository, vol. xxvi. p. 441.

† Annales d'Hygiène, vol. i. 512.

‡ Christison, p. 675. Other experiments have tested its efficacy. Persoz and Nonat, Annales d'Hygiène, vol. iv. p. 435; Simeon, Brande's Journal, N. S., vol. v. p. 421. Dr. T. D. Mitchell says that the *American Fire King* (a rival to Chabert) took chlorine water to prevent the effects from swallowing prussic acid. (Chemistry, p. 184.)

§ London Medical Gazette, vol. xvii. p. 716. In a case related by Mr. Garson, (Edinburgh Medical and Surgical Journal, vol. lix. p. 72,) where the quantity taken was a teaspoonful, but which had been long kept, and the effects were not manifested before a quarter of an hour, and then the eyes were fixed, the jaws closed, the pupils a little contracted and insensible, and the pulse weak and quick. The cold affusion was applied along the spine, and ammoniated alcohol and the solution of chloride of lime were introduced into the mouth. Mustard cataplasms were also employed. They produced some reaction. He was bled eight ounces, but it was followed by severe convulsions. The cold affusion was continued, and bottles of hot water

Cold affusion was first advised by Dr. Herbst, of Gottingen, and is certainly a most valuable remedy. Even in the stage of insensibility and paralysis, it has been successfully used. It often requires to be repeated several times; and in extreme cases, the first sign of amendment is a renewal of the spasms of the muscles.* It should be used in connection with the inhalation of chlorine or ammonia.

Mr. Pereira also attaches great importance in these cases to the faithful continued use of artificial respiration. It is still very unsettled whether venesection is to be recommended. Some authors deem it a decidedly fatal measure, while others recommend it for relieving cerebral congestion. Dr. Lonsdale advises bleeding from the jugular vein in order to unload the congested cavities of the right side of the heart, and adduces in favor of this, some successful experiments on animals.

The opinion of Dr. Jorg, and which is confirmed by subsequent observers, that prussic acid paralyzes the lungs, is well worthy of being kept in mind. Most of the successful remedies act by restoring their power.†

Oil of turpentine, coffee, etc., have deservedly lost their reputation in these cases, and it is also well to add that the sulphate of iron, recommended by Sir George Lefevre, (*Lancet*, June 29, 1844,) is not an antidote. Nor is, I fear, the preparation announced by Messrs. Smith, of Edinburgh, one. It appears to be iron, partly in the state of peroxide, and partly in that of protoxide. The idea is, that Prussian blue is produced on meeting with the acid. It is just to add that there was a favorable result in some experiments on animals.‡

The *hydrocynates of ammonia and potash* are as poisonous as

were applied to his body. Four drachms of ammoniated alcohol and as much chloride of lime had now been given, and it was thought advisable to rely on brandy alone, which was administered in teaspoonsful. At the end of four hours he became sensible, and after that gradually improved, and in a few days was quite well.

* Herbst, *Edinburgh Medical and Surgical Journal*, vol. xxxii. p. 229. Orfila confirms its value. (*Annales d'Hygiène*, vol. i. p. 520.)

A striking case, illustrating its utility in arousing the nervous system is related by Dr. Banks. (*Edinburgh Medical and Surgical Journal*, vol. xlviii. p. 44.)

† Magendie's *Formulary*, p. 95.

‡ *Athenæum*, 1844, p. 782.

the original acid. This has been proved by the experiments of Coullon, Robiquet, Magendie, and Schubarth;* but the *triple prussiates* (ferrocyanates) do not possess deleterious properties. The *sulphocyanic acid*, although once supposed to be a very active poison, is not found to act with much energy on animals. Dr. Westrumb, of Hammeln, however, observed very active effects from the *sulphocyanate of potash*. Two scruples, dissolved in water, killed a dog in seven minutes.†

Hydrocyanic ether possesses the properties of the acid, though in a mitigated form. "Six drops in the gullet of a dog immediately caused deep inspirations, falling on his side, and subsequently cerebral congestion and a remarkable agitation of the paws. This continued for four minutes, then gradually diminished, and in half an hour had mostly disappeared. The injection of six drops into the jugular vein was quickly followed by death, with phenomena as in that by prussic acid.‡

I transfer from the succeeding chapter to this place a brief notice of the Cyanides or Cyanurets:—

Cyanuret of iodine. Orfila ranks this among the narcotico-acrid poisons, in consequence of the experiments of Scoutetten. When it was given to dogs, convulsions almost instantly occurred, with immediate death. Half a grain was sufficient to destroy a rabbit, and five grains a dog. The stomach was generally found somewhat inflamed.§

Lassaigne appears also to have experimented with it. One grain and a half given to a dog produced attempts to vomit, paralysis of the limbs, dilatation of the pupils, and stiffness. Death succeeded at the end of fifteen minutes. The body was opened immediately. There was intense inflammation of the stomach, with an ulceration at the cardiac extremity. The upper part of the duodenum was also red.||

* Christison, p. 661.

† Ibid., p. 663. Tiedemann and Gmelin, in their experiments on digestion, ascertained that the *sulphocyanate of potash* is contained in the human saliva. (Edinburgh Medical and Surgical Journal, vol. xxvii. p. 420.)

‡ London Medical Gazette, vol. xxvi. p. 895.

§ Orfila's Toxicology, third edition, vol. ii. p. 344.

|| London Medical Repository, vol. xxiv. p. 573, from Journal de Chimie Médicale.

The *cyanuret of bromine* would seem, from the experiments of Serrulas and Barthez, to be equally deleterious. One grain, dissolved in water and given to a rabbit, instantly killed it.* Ten grains proved fatal to a strong dog, producing violent tetanic spasms, followed by signs of extensive and excessive irritation. The lungs were found congested, and the whole extent of the intestines was more or less of an intense vascularity. The villous coat of the stomach appeared as if soaked in blood.†

But the most important in its present bearing, both from its employment in the arts and its use as a medicine, is the *Cyanuret or cyanide of potassium*. A few grains placed on the tongue of a dog produced marks of inflammation. A tenth of a grain killed a linnet in sixty seconds, and less than one grain, a Guinea-pig in two or three minutes. These experiments were made by Robiquet and Villermé.‡ It has also proved poisonous when given as an enema; six grains *moistened*, but yet in a mass, being added to six ounces of water. The effects were strong convulsions, violent contractions of the limbs, and dilated pupils. The patient, however, recovered soon from these. A fourth enema was subsequently given, of the same ingredients, except that the cyanuret was *boiled in it, and so moist* that it adhered to the sides of the injection-bag. No bad effects followed. A fifth was given in thirty-six hours after, with the same quantity of well-dried cyanuret. Convulsions, difficult respiration, and dilated pupils followed, and the patient died in an hour. The difference in effect is ascribed to the decomposition of the cyanuret by moisture.§

We have also cases of its fatal effects when swallowed, and of which I shall adduce only a single one. M. Macé, a physician at St. Malo, prescribed for a patient 4 grammes of the cyanuret, to be infused in 60 grammes of orange-flower water and 15 of syrup, one spoonful to be taken three times a day,

* Philosophical Magazine and Annals, vol. i. p. 397; American Journal of Medical Sciences, vol. iii. p. 479.

† Glover, in Edinburgh Medical and Surgical Journal, vol. lviii. p. 351.

‡ Edinburgh Medical and Surgical Journal, vol. xxi. p. 394.

§ Orfila, Annales d'Hygiène, vol. xi. p. 240. The case occurred to Dr. Trouve.

(a gramme is 15.434 grains.) The patient died in three-quarters of an hour after taking the first. On examination, marks of organic disease were discovered, but not sufficient to cause so sudden a death. Dr. Macé urged that he had prescribed only a teaspoonful. The tablespoonful mixed with food and given to animals, induced immediate death. He was convicted of involuntary homicide, fined and imprisoned.* [The increased use of this substance in photography and for removing stains, has led to numerous accidents.]†

[A death occurred in Macon, Georgia, in the spring of 1846, from an overdose of the cyanide of potassium; but in this case it was the doctor, and not the patient, who was poisoned. Dr. Baber prescribed a solution of the cyanide for a patient, after a formula which he found in Morton's edition of Ellis' Medical Formulary. Owing to a mistake of the printer, the formula directed a quantity of cyanide eight times greater than was intended. The patient, warned of the dangerous nature of the preparation by the apothecary, appealed to the doctor; and he, confident in the correctness of the prescription, swallowed about three tablespoonfuls of the mixture, and died in a few minutes. The quantity of the poison taken, according to Dr. Morton, in a MS. letter to Dr. Beck, dated April 13th, 1846, was about four and a half grains. The remainder of the edition of the book was cancelled by the publisher, and the outstanding copies, as far as possible, recalled.]

As this substance acts with great rapidity, we can scarcely use any remedy with much hopes of success. The green sulphate of iron has been advised, as it will produce Prussian blue by the decomposition of the poison. It is decomposed by acids and prussic acid set free.

The tests to be employed are very similar to those for the detection of prussic acid.

Chloride of cyanogen, (chlorocyanic acid.) Serullas, who first obtained this substance in a pure state, found it highly poisonous. A grain dissolved in alcohol and introduced into

* Lancet, N. S., vol. xxxi. p. 582; Chemist, vol. iv. p. 42. There are a number more of fatal cases on record.

† Med. Times and Gazette, October, 1850; November, 1850; July, 1851.

the œsophagus of a rabbit, killed it instantly. An ounce of water, in which another grain had been agitated, destroyed a rabbit in twenty-five minutes.* "It is corrosive to the skin, and highly injurious to animal life."†

We come next to the consideration of those vegetables which contain hydrocyanic acid, and of which it constitutes the poisonous ingredients.‡ They may be arranged as follows:—

Prunus lauro-cerasus, L. *Cerasus lauro-cerasus*, D. C. Cherry-laurel.

Prunus avium, L. *Cerasus avium*, D. C. Black-cherry; its kernels.

Prunus padus, L. *Cerasus padus*, D. C. Bird cherry-tree, cluster cherry; its bark.

Prunus virginiana, L. *Cerasus virginiana*, Mx. Wild cherry-tree.

Prunus nigra, Ait. *Cerasus nigra*, D. C. Black cherry-tree.

Prunus caroliniana, Ait. *Cerasus caroliniana*, Mx. Wild orange.

The three last are natives of the United States.

Amygdalus communis, L. Bitter almonds.

Amygdalus persica, L. *Persica vulgaris*, D. C. The peach; its kernels, leaves and flowers.

Sorbus aucuparia, L. *Pyrus aucuparia*, D. C. Mountain ash, Rowan-tree.§

The poison obtained from these various substances exists in two forms—as distilled water, and as an essential oil; and it is in these products that the peculiar odor, already spoken of, is observed. It is present even after the acid is thrown down by the iron test; and, of course, it is a probable conjecture that it is owing to some substance other than the acid itself.

* Silliman's Journal, vol. xvi. p. 258.

† Turner's Chemistry, fifth edition, p. 436.

‡ It is not by any means certain, indeed probably otherwise, that the acid exists ready formed in the above-named vegetable. It is probably the result of various processes, of which the most certain is distillation, and again the reaction of various constituents would seem to form it. The bitter almond is the most striking illustration. "None of the acid exists ready formed in it, nor is the poison ever produced except by the agency of water or the almond pulp. Thus the very act of mastication produces from the pulp the poison which destroys life, for prussic acid is formed on contact with the saliva. Heat is not required, etc.," although, of course, it will produce a more active poison. (Taylor on Poisons, p. 707.)

§ We may add to these, I presume, *Cerasus capricida*, (Wallich. ;) *Prunus undulata*, (Don. ;) so poisonous as to kill goats in Nepal. (LINDLEY.)

Prunus lauro-cerasus.* (Cherry-laurel.) The distilled water of this plant, (doubtless containing variable quantities of the essential oil, and which oil has been shown by Robiquet to possess all the chemical properties of the oil of bitter almonds,) has been proved a poison by numerous experimenters.†

When applied to wounds in animals, it induced vomiting, convulsions, great prostration of strength, diminished sensibility, and death. Injected into the stomach and rectum, it excited a similar train of symptoms, except that in the latter the convulsions were more violent, and tetanus of the extremities was present. Its action was most rapid and intense when injected into the jugular vein.‡

Several cases are recorded of its effects on the human subject. One of the earliest happened in Dublin, in 1728: Martha Boyse, servant to a person who sold large quantities of this water, gave to her mother a bottle of it, and by the latter it was given to Frances Eaton, her sister. Mrs. Eaton was a shopkeeper, and thinking it a compliment to her customers, offered them some. Among others, one Mary Whaley drank of it, went to another shop, and in about a quarter of an hour complained of a violent disorder in her stomach. She was carried home, and from that time lost her speech, and died in about an hour, without vomiting or purging, or any convulsions. Mrs. Ann Boyse was informed of this, and came immediately to her sister. She affirmed that it could not have been

* Schrader, an apothecary at Berlin, was the individual who discovered that the prussic acid is contained in the aqua lauro-cerasi and the distilled water of the flowers of the peach-tree, as likewise in the infusion of bitter almonds. (London Medical and Physical Journal, vol. x. p. 95.) Bergmann, also an apothecary at Berlin, discovered in 1811, that the bark of the *prunus padus* contained a notable quantity of it. (Annals of Philosophy, vol. v. p. 28.) See also a paper by Vauquelin, on the presence of prussic acid in vegetables, from the *Annales de Chimie*. (Repertory of Arts, second series, vol. ii. p. 461.) He detected this substance in the kernels of apricots.

† Orfila enumerates the following: Madden, Mortimer, Brown, Langrish, Nicholls, Stenzlius, Heberden, Watson, Vater, Rattray, the Abbé Rozier, Duhamel, and Fentana; and we may add Robiquet, and Taddei. The last made his experiments at Florence, in the laboratory of the Marquis Ridolfi. (London Medical Repository, vol. xvi. p. 431.)

‡ Orfila's Toxicology, vol. ii. pp. 148 to 153. Also an analysis of the experiments of Fontana, in the Medical Commentaries, vol. xii. p. 106.

the cordial that caused the death, and to convince her of it, she filled out three spoonful and drank it, and shortly after, two more. In a few minutes she died, without a groan or convulsions.*

Foderé says that when he was attending his studies at Turin, in 1784, the chamber-maid and man-servant of a noble family of that town stole (for the purpose of regaling themselves) from their master a bottle of distilled laurel water, which they took for an excellent cordial. Fearful of being surprised, they hastily swallowed, one after the other, several mouthful of it, but they soon paid the price of their dishonesty, for they expired almost instantly in convulsions. The dead bodies were carried to the university for examination. The stomach was found highly inflamed, but the rest of the organs were in a sound state.†

It has also formed the subject of investigation in a very interesting criminal trial, whether this substance was the cause of death. The case was that of Captain Donellan for the murder of Sir. T. Boughton. Its importance requires that a full abstract should be given:—

Sir Theodosius Boughton was a young gentleman of fortune, in the County of Warwick, in England, and nearly arrived at the age of twenty-one. His mother, and his brother-in-law, Captain Donellan, and his sister, Mrs. Donellan, resided with him. In the event of his dying before the period of his

* Philosophical Transactions, vol. xxxvii. p. 84. Communicated by Dr. Madden. His experiments on animals are also contained in the same article. Dr. Mortimer's, in vol. xxxvii. p. 163; Fontana's, in vol. lxx. p. 163. In 1782, Dr. Price, of Guildford, having professed to convert mercury into gold, offered to repeat his experiments before a competent tribunal; but the unfortunate philosopher put a period to his existence before the day appointed for his exhibition, by a draught of laurel-water. (Paris Medical Jurisprudence, vol. ii. p. 401.)

† Foderé, vol. iv. p. 27. Even the *leaves* are noxious, as the following extract will show: "1819. Several children at a boarding-school near Richmond, having partaken of some custard, flavored with the leaves of the cherry-laurel, four of them were taken severely ill. Two of them, a girl of six, and a boy of five years of age, fell into a profound sleep, out of which they could not be roused in ten hours; the other two complained of pain in the epigastric region. By proper medical treatment, they all recovered, after an illness of three days." (Paris' Med. Jurisprudence, vol. ii. p. 402.)

majority, the greatest part of his fortune descended to his sister, and Captain Donellan would thus become entitled to a life estate in it.

Sir Theodosius was laboring under a slight venereal affection, for which he was attended by Mr. Powell, an apothecary at Rugby. His general health is, however, stated to have been good. On the 29th of August, 1780, Mr. Powell sent him a draught to be taken on the next morning, consisting of rhu-barb and jalap, each fifteen grains; spirits of lavender, twenty drops; nutmeg water, two drachms; simple syrup, two drachms; and an ounce and a half of simple water. The bottle containing this draught was placed on a shelf in his bedroom.

Sir Theodosius returned in the afternoon of this day from fishing, in good health and spirits. In the morning, a servant awoke him at an early hour, for the purpose of obtaining some straps for a net. He arose, and went into the next room for them. Even now he appeared in perfect health. About 7 A.M. Lady Boughton got up and went into his room, as he had before desired her to give him the medicine. She inquired whether he had taken it, or whether he chose that she should give it to him. He desired her to reach down the draught, which was labeled "Purging draught for Sir T. B.;" and she poured it into a cup, for the purpose of his taking it. He had not, however, swallowed more than half of it, when he complained that it was so nauseous to the taste and disagreeable to the smell that he did not apprehend that he should be able to keep it on his stomach. This remark induced Lady Boughton to smell the draught. She found it very peculiar in this respect, and observed to him that it smelt very strongly of bitter almonds. He ate some cheese, in order to take the taste out of his mouth, and afterwards washed his mouth with a little water. In about two minutes after swallowing the draught, he appeared to struggle very much, as if to keep it down, and had a rattling and gurgling at his stomach. These symptoms continued about ten minutes, when he seemed to Lady Boughton to be inclined to go to sleep, and she left the room. She returned again in about five minutes, and was surprised to find him with his eyes fixed upward, his teeth clenched, and froth running out of his mouth. He died in

about half an hour afterwards, having never spoken since he took the draught.

Mr. Donellan came into the room when Sir Theodosius was dying, and inquired of Lady Boughton where the physic bottle was. She showed it to him. He immediately took it and poured water into it, shook it, and then emptied its contents into the wash-hand basin. And he persisted in doing this with another bottle, although Lady Boughton remonstrated, and objected to his conduct. Mr. Powell was sent for, but arrived after the death of Sir Theodosius.

It appeared also in evidence, that Captain Donellan had a still in his own room, and that he had used it for distilling roses. Some days after the death of Sir T., he brought this still to one of the servants to be cleaned. It was full of lime, and the lime was wet. On the other hand, it appeared on the cross-examination of Lady Boughton, that Sir T., a short time before his death, had bought a quantity of arsenic, in order to poison fish, and some of this was afterwards found locked up in his closet.

Suspicions soon began to be excited as to the cause of this sudden decease; and when these reached the ears of Sir William Wheeler, the guardian of the young baronet, he wrote to Captain Donellan, informing him of the rumors that were abroad, and requesting him to have the body opened in order to satisfy the family and the public. Donellan, in his answer, immediately consented to this, and sent for some medical gentlemen. He, however, did not explain to them the cause of his request; and as they were thus led to suppose it merely an ordinary case, they declined the performance, from the circumstance that the body was already far advanced in a state of putrefaction. It is not necessary, nor indeed does it belong to this statement, to enumerate the various devices by which Captain Donellan evidently attempted to elude the wishes of Sir William Wheeler respecting a dissection. On the eighth day after death the body was buried, but it was taken up immediately after by the coroner, and opened. It was found swollen and distended, the face was black, the lips swollen and retracted, and showing the gums, the teeth black, the tongue

protruding, and the skin spotted in many parts of the body. "The orifices and small arch of the stomach, and the intestines, bore the appearance of inflammation, the heart was natural, the lungs were suffused with blood, looking red and spotted in many places, with black specks, and on the back part the blood had settled in a deep-red color, almost approaching to purple; the diaphragm was in the same state, and in general, upon the depending surfaces of the body, the blood was settled in the like manner; the kidneys appeared black as tinder, and the liver much in the same state." There was also some blood extravasated in the thorax.

Several physicians and surgeons—Dr. Rattray, Dr. Ashe, Dr. Parsons, Professor of Anatomy at Oxford, and Mr. Wilmer—deposed that they had performed experiments on animals with laurel-water, and found the effects very similar to the symptoms in the case of Sir Theodosius. Death succeeded in a few minutes after having been preceded by convulsions. The appearances on dissection also agreed.

It may be mentioned in this place that Mr. Powell prepared a draught precisely alike to that which he had sent to the baronet, with the addition of some laurel-water, and Lady Boughton, on being requested to smell this, stated that it resembled the one she had given to her son.

The counsel for the prisoner, in their cross-examination, inquired of the medical witnesses whether the presence of epilepsy or apoplexy would not account for the symptoms observed. To this a negative answer was given. Dr. Parsons thought they resembled the latter most, but he was decided in attributing them to the effects of the medicine. Sir Theodosius was young, and of a thin habit, and it was hence very improbable that apoplexy should have caused his death.

They also inquired whether the appearances observed on dissection might not be the effects of putrefaction. It was allowed that the external might, but not the internal.

On the part of the prisoner, the celebrated John Hunter was summoned as a witness. As this is probably the only time when that distinguished surgeon appeared before a court to testify in a case of poisoning, and as his examination is pecu-

liarily interesting, I conceive that I shall do a service by quoting it entire:—

MR. JOHN HUNTER sworn; examined by Mr. Newnham.

Question. Have you heard the evidence that has been given by these gentlemen?

Answer. I have been present the whole time.

Q. Did you hear Lady Boughton's evidence?

A. I heard the whole.

Q. Did you attend to the symptoms her ladyship described, as appearing upon Sir Theodosius Boughton, after the medicine was given him?

A. I did.

Q. Can any certain inference, upon physical or chirurgical principles, be drawn from those symptoms, or from the appearances externally or internally of the body, to enable you, in your judgment, to decide that the death was occasioned by poison?

A. I was in London then; a gentleman, who is in court, waited on me with a copy of the examination of Mr. Powell and Lady Boughton, and an account of the dissection, and the physical gentlemen's opinion upon that dissection.

Mr. Newnham. I don't wish to go into that; I put my question in a general way.

A. The whole appearances upon the dissection explain nothing but putrefaction.

Q. You have been long in the habit of dissecting human subjects? I presume you have dissected more than any man in Europe?

A. I have dissected some thousands during these thirty-three years.

Q. Are those appearances you have heard described, such, in your judgment, as are the result of putrefaction in dead subjects?

A. Entirely.

Q. Are the symptoms that appeared after the medicine was given such as necessarily conclude that the person had taken poison?

A. Certainly not.

Q. If an apoplexy had come on, would not the symptoms have been nearly or somewhat similar?

A. Very much the same.

Q. Have you ever known or heard of a young subject dying of an apoplectic or epileptic fit?

A. Certainly; but with regard to the apoplexy, not so frequent. Young subjects will perhaps die more frequently of epilepsies, than old ones. Children are dying every day from teething, which is a species of epilepsy arising from an irritation.

Q. Did you ever, in your practice, know an instance of laurel-water being given to a human subject?

A. No, never.

Q. Is any certain analogy to be drawn from the effects of any given species of poison upon an animal of the brute creation, to that it may have upon a human subject?

A. As far as my experience goes, which is not a very confined one, because I have poisoned some thousands of animals, they are very nearly the same. Opium for instance, will poison a dog, similar to a man. Arsenic will have very near the same effect upon a dog as it would have, I take for granted, upon a man. I know something of the effects of them, and I believe their operation will be nearly similar.

Q. Are there not many things which will kill animals almost instantaneously, that will have no detrimental or noxious effect upon the human subject? spirits, for instance, occur to me.

A. I apprehend, a great deal depends upon the mode of experiment. No man is fit to make one, but those who have made many, and paid considerable attention to all the circumstances that relate to experiments. It is a common experiment, which I believe seldom fails, and is in the mouth of everybody, that a little brandy will kill a cat. I have made the experiment, and have killed several cats; but it is a false experiment. In all those cases where it kills the cat, it kills the cat by getting into her lungs, not into her stomach; because if you convey the same quantity of brandy, or three times as much into the stomach, in such a way as the lungs shall not be affected, the cat will not die. Now in those experiments that are made by forcing an animal to drink, there are two operations going on: one is refusing the liquor by the animal, and its kicking and working with its throat to refuse it; the other is a forcing the liquor upon the animal; and there are few operations of that kind but some of the liquor goes into the lungs. I have known it from experience.

Q. If you had been called upon to dissect a body suspected to have died of poison, should you or not have thought it necessary to have pursued your search through the guts?

A. Certainly.

Q. Do you not apprehend that you would have been more likely to receive information from thence, than from any other part of the frame?

A. That is the track of the poison, and I certainly should have followed that track through.

Q. You have heard of the froth issuing from Sir Theodosius' mouth a minute or two before he died. Is that peculiar to a man dying of poison, or is it not very common in many other complaints?

A. I fancy it is a general effect of people dying in what you may call health, in an apoplexy or epilepsy—in all sudden deaths, where a person was a moment before that in perfect health.

Q. Have you ever had an opportunity of seeing such appearances upon such subjects?

A. Hundreds of times.

Q. Should you consider yourself bound, by such an appearance, to impute the death of the subject to poison?

A. No, certainly not; I should rather suspect an apoplexy; and I wish, in this case, the head had been opened, to remove all doubts.

Q. If the head had been opened, do you apprehend all doubts would have been removed?

A. It would have been still further removed, because, although the body

was putrid so that one could not tell whether it was a recent inflammation, yet an apoplexy arises from an extravasation of blood in the brain, which would have laid in a coagulum. I apprehend, although the body was putrid, that would have been much more visible than the effect any poison could have had upon the stomach and intestines.

Q. Then, in your judgment, upon the appearances the gentlemen have described, no inference can be drawn from thence that Sir Theodosius Boughton died of poison?

A. Certainly not; it does not give the least suspicion.

Cross-examined by Mr. Howorth.

Q. Having heard the account to-day that Sir Theodosius Boughton, apparently in perfect health, had swallowed a draught which produced the symptoms described, I ask you whether any reasonable man can entertain a doubt that that draught, whatever it was, produced those appearances?

A. I don't know well what answer to make to that question.

Q. Having heard the account given of the health of this young gentleman on the morning previous to taking the draught, and the symptoms that were produced immediately upon taking the draught, I ask your opinion, as a man of judgment, whether you don't think that draught was the occasion of his death?

A. With regard to his being in health, that explains nothing. We frequently, and indeed generally, see the healthiest people dying suddenly; therefore I shall lay little stress upon that. As to the circumstances of the draught, I own they are suspicious: every man is as good a judge as I am.

Court. You are to give your opinion upon the symptoms only—not upon any other evidence given.

Mr. Howorth. Upon the symptoms immediately produced after the swallowing of that draught, I ask whether, in your judgment and opinion, that draught did not occasion his death?

A. I can only say, that it is a circumstance in favor of such an opinion.

Court. That the draught was the occasion of his death?

A. No; because the symptoms afterwards were those of a man dying who was before in perfect health; a man dying of an epilepsy or apoplexy, the symptoms would give one those general ideas.

Court. It is the general idea you are asked about now, from the symptoms that appeared upon Sir Theodosius Boughton immediately after he took the draught, followed by his death so very soon, whether, upon that part of the case, you are of opinion that the draught was the occasion of his death?

A. If I knew the draught was poison, I should say, most probably, that the symptoms arose from that; but when I don't know that that draught was poison,—when I consider that a number of other things might occasion his death,—I cannot answer positively to it.

Court. You recollect the circumstance that was mentioned, of a violent heaving of the stomach?

A. All that is the effect of the voluntary action being lost, and nothing going on but the involuntary.

Mr. Howorth. Then you decline giving any opinion upon the subject?

A. I don't form any opinion to myself. I cannot form an opinion, because I can conceive if he had taken a draught of poison, it arose from that: I can conceive it might arise from other causes.

Q. If you are at all acquainted with the effects and operations of distilled laurel-water, whether the having swallowed a draught of that, would not have produced the symptoms described?

A. I should suppose it would. I can only say this of the experiments I have made of laurel-water upon animals, it has not been near so quick. I have injected laurel-water into the blood of dogs, and they have not died. I have thrown laurel-water, with a precaution, into the stomach, and it never produced so quick an effect with me as described by those gentlemen.

Q. But you admit that laurel-water would have produced symptoms such as I have described?

A. I can conceive it might.

Mr. Newham. Would not an apoplexy or epilepsy, if it had seized Sir Theodosius Boughton at this time, though he had taken no physic at all, have produced similar symptoms, too?

A. Certainly.

Q. Where a father has died of apoplexy, is that not understood, in some measure, to be constitutional?

A. There is no disease whatever that becomes constitutional, but what can be given to a child. There is no disease which is acquired, that can be given to a child; but whatever is constitutional in the father, the father has a power of giving that to the children, by which means it becomes what is called hereditary. There is no such thing as an hereditary disease, but there is an hereditary disposition for a disease.

Mr. Howorth. Do you call apoplexy constitutional?

A. We see most diseases are constitutional. The smallpox is constitutional, though it requires an immediate cause to produce the effects. The venereal disease is hereditary. I conceive apoplexy as much constitutional as any disease whatever.

Q. Is apoplexy likely to attack a thin young man, who had been in a course of taking cooling medicines before?

A. Not so likely, surely, as another man; but I have in my account of dissections, two young women dying of apoplexies.

Q. But in such an habit of body, particularly attendant with the circumstance of having taken cooling medicines, it was very unlikely to happen?

A. I do not know the nature of medicines so well as to know that it would hinder an apoplexy from taking effect.

Court. Give me your opinion in the best manner you can, one way or the other, whether, upon the whole of the symptoms described, the death proceeded from that medicine, or any other cause?

A. I do not mean to equivocate, but when I tell the sentiments of my own mind, what I feel at the time, I can give nothing decisive.

The judge, (the Hon. Francis Buller,) in summing up the evidence, after stating that four medical witnesses were decided

in attributing the death to the effects of laurel-water, made the following comments on the testimony of Mr. Hunter: "For the prisoner, you have had one gentleman called, who is likewise of the faculty, and a very able man. I can hardly say what his opinion is, for he does not seem to have formed any opinion at all of the matter. He, at first, said he could not form an opinion whether the death was or was not occasioned by the poison, because he could conceive that it might be ascribed to other causes. I wished very much to have got a direct answer from Mr. Hunter, if I could, what, upon the whole, was the result of his attention and application to the subject, and what was his present opinion; but he says he can say nothing decisive. So that, upon this point, if you are to determine upon the evidence of the gentlemen who are skilled in the faculty only, you have the *very positive* opinion of four or five gentlemen of the faculty that the deceased died of poison. On the other side, you have what I really cannot myself call more than the *doubt* of another; for it is agreed by Mr. Hunter that the laurel-water would produce the symptoms which are described. He says an epilepsy or apoplexy would produce the same symptoms; but as to an apoplexy, it is not likely to attack so young and so thin a man as Sir Theodosius was; and as to an epilepsy, the other witnesses tell you they don't think the symptoms which have been spoken of do show that Sir Theodosius had any epilepsy at the time."

The jury retired for nine minutes, and then brought in a verdict of guilty, and Captain Donellan was executed in a few days thereafter.*

It was, and still is, a prevailing opinion with several that Sir Theodosius Boughton was not poisoned, and that Captain

* This abstract is taken from a folio pamphlet, entitled "The trial of John Donellan, for the willful murder of Sir Theodosius Edward Allesley Boughton, Bart., at the Assize at Warwick, on Friday, March 30, 1781, before the Hon. Francis Buller, Esq., one of the Justices of his Majesty's Court of King's Bench. The second edition. Taken in short-hand by Joseph Gurney." London, 1781. I have, in previous editions, stated that the jury retired for an hour. This, according to Gurney, is incorrect. They withdrew, he says, at twenty-five minutes after 6 P. M., and returned into court at thirty-five minutes after six, with the verdict.

Donellan was innocent. Mr. Dease notices this case as "a melancholy and striking instance of the unhappy effects of popular prejudice, and the fatal consequences of medical ignorance."* Mr. Phillips, in his "Theory of Presumptive Proof," adduces it as an instance where a man was unwarrantably condemned on circumstantial evidence.†

I cannot agree with either of these gentlemen, although I will readily allow that too much dependence was placed on the appearances found on dissection. Putrefaction was evidently too far advanced to render them a certain ground of testimony.

As a medical man, it might be inquired of Mr. Dease, whether the symptoms preceding this death have not been most strikingly and astonishingly verified, as *probably* originating from laurel-water by the subsequent investigations of chemists and physicians? Mr. Hunter, in his testimony, says that he had never known laurel-water to act so rapidly as the other medical witnesses described. He had injected it into the veins and into the stomach of animals, *but it never produced so quick an effect*. Who, I would ask, have subsequent experiments proved to be right on this point—Mr. Hunter or the other witnesses? Let the facts I have adduced in previous pages answer this question.

Again, Mr. Phillips and others object greatly that the whole proof as to its being laurel-water rested upon the comparison of the smell. Now, I conceive this to be a very satisfactory circumstance. The medicine administered by Mr. Powell did not contain laurel-water, while few, very few indeed, of the fluids in common use possess a smell at all resembling that of bitter almonds. This property is peculiar, confined to a certain number of vegetable products, several of which, even at that day, were known to be deleterious.

Captain D. had a still in his own room; there were laurels and bays in the garden, (see Amos' testimony.) This is a sufficient answer to Mr. Phillips' question, *where did the prisoner*

* Dease, in Cooper's Tracts, p. 88. I owe every apology to Dr. Male, for incorrectly using his name in a previous edition. Dr. Gordon Smith kindly and truly explained the reason of my mistake, in the London Medical Repository, vol. xxii. p. 521; and again in his work on Medical Evidence, p. 183.

† Appendix to his Treatise on the Law of Evidence, p. 30.

procure it? Certainly, if there was an intention on the part of Captain Donellan to use the laurel-water for the purpose of poisoning, we have shown *how he could obtain it*.*

Another circumstance has been stated of late years, which adds to the irresistible weight of testimony in this case. It was first pointed out to me by my friend, the Hon. Benj. F. Butler, (then Attorney-General of the United States,) in Colton's Lacon, and if this should be objected to as anonymous or doubtful authority, it is confirmed by Burnett. The remarks in Lacon are as follows:—

“In the case of Donellan, who was executed for poisoning Sir T. Boughton with distilled laurel-water, some circumstances were elicited that would have weighed more strongly in the judgment of reflecting minds than any positive but single affidavit which might have been brought to contradict them. A still that had been recently used was discovered on the premises. Donellan was so bad a chemist that, on being asked for what purpose he had procured this machine, he replied, ‘that he used it to make lime-water to kill the fleas;’ not knowing that lime-water could only be made by saturating water with lime, and that a still never was and never can be applied to such a purpose. *But in his library there happened to be a single number of the Philosophical Transactions, and of this single number the leaves had been cut only in one place, and this place happened to contain an account of the mode of making laurel-water by distillation.*”†

As to the opinion of medical jurists, I will only adduce that of Christison. “For my part,” says he, “taking into account the general as well as medical circumstances of the case, I do not entertain a doubt of his guilt.”‡ Sir Henry Hallford, in

* The fact of Captain Donellan's having a still is cautiously omitted in Mr. Phillips' statement of the case. Nor is this a solitary instance of omission; and in proof of this, I request any gentleman to compare the abstract I have given (and which is taken almost verbatim from the trial) with that presented by Mr. Phillips. His comments on the medical testimony are evidently founded on imperfect information concerning the subject in dispute.

† Burnett's Medical Botany, vol. ii., *Prunus lauro-cerasus*. It is of no use to quote the volume and page of Lacon, as the editions are so numerous. It is No. 575 in the edition I have used.

‡ Christison on Poisons, p. 685.

1833, uses this language: "Sir T. Boughton, who was poisoned by Captain Donellan in 1780, with laurel-water."* I shall have occasion hereafter to notice the regrets of John Hunter concerning his testimony.

The oil of laurel also acts as a violent poison.

Prunus padus. The essential oil of this contains, according to Schrader, 9.25 per cent. of hydrocyanic acid. Both its distilled water and essential oil are poisonous to animals, and even its fruit is injurious to them.†

Prunus virginiana. (Wild cherry-tree.) Its leaves are poisonous to certain animals, as calves, while its berries intoxicate birds. Dr. Morris, in his inaugural dissertation at Philadelphia, in 1802; mentions that he destroyed kittens, etc., with its distilled water. Mr. Proctor detected the hydrocyanic acid in its bark.‡

He obtained an oil by distillation from the bark, a drop of which placed on the tongue of a cat caused convulsions, loss of power in the posterior extremities, and general prostration. These symptoms went off in half an hour. This oil also appears to be abundant in the kernels of the fruit.

Mr. Proctor supposes this oil, when purified, to be identical with the hydruret of benzule (purified oil of bitter almonds) of Liebig and Wohler; and that its deleterious properties are due to prussic acid alone, as the hydruret has no sensible effect on the animal economy, other than its disagreeable taste.§

Dr. Price, of Centreville, Ohio, states that in 1834 there was a great scarcity of cultivated fruit, but an abundance of wild cherries, of which children generally partook freely. A number of cases similar to the following occurred under his

* Halford's Essays, p. 158. I should not, in this work, notice the novel of "Sir Theodosius Boughton, or Laurel-Water," by Mr. G. P. R. James, were it not for his preface. With all due respect for his talents as a novelist and a historian, I must say that he has not investigated the case with that care that should render his opinion on its merits of any value.

† Loewig asserts that this oil is identical with the oil of bitter almonds. (*Journal de Pharmacie*, vol. xxii. p. 514.)

‡ Barton's *Materia Medica*, part. i. p. 11, part ii. p. 22; *Philadelphia Journal of Pharmacy*, vol. vi. p. 11.

§ *Philadelphia Journal of Pharmacy*, vol. ix. p. 298.

own observation: In a few hours after eating this fruit, a child was seized with vomiting, stupor, dilated and insensible pupil; loss of strength; small and frequent pulse; pale skin; clenched jaws, inability to swallow or speak; and cold extremities. The case was successfully treated with aqua ammoniæ, after forcing open the jaws; sinapisms to the stomach and extremities; injection of Epsom salts, followed by a cathartic.

Many birds were intoxicated by this fruit, and easily caught.*

[A flavoring ingredient for puddings, cakes, custards, tarts, and cordials, if freely used by cooks and confectioners, which is six times more deadly than the prussic acid of the London Pharmacopœia. It is called *ratafia*.]†

Prunus nigra. (Black cherry-tree.) Its bark, infused in cider, proved poisonous to several persons in this State some years since.

Prunus caroliniana. (Wild orange.) Elliot remarks that its leaves are very poisonous, and frequently in the spring of the year destroy cattle that are tempted to browse freely on them.‡

Amygdalus communis. (Bitter almonds.) These, when pounded and taken in sufficient quantity, prove highly deleterious, as has been proved by numerous experimenters.

The essential oil of bitter almonds acts violently. One drop applied to the tongue of a cat instantly excited convulsions, to which loss of motion and insensibility succeeded; the respiration became hurried, and death followed at the end of five minutes. So also when two drops were injected into the rectum. While performing these experiments, Mr. Brodie touched his tongue with a probe that had been dipped into the oil. He instantly experienced an uneasy sensation in the epigastric region, and a weakness of the limbs. The application of the oil to the cellular texture was equally, but not as instantaneously, destructive.§

* Western Journal of Medical and Physical Sciences, vol. xi. p. 191.

† British and Foreign Medico-Chirurgical Review, 1851.

‡ Elliot's Botany, vol. i. p. 540; North American Archives, vol. ii. p. 31.

§ Brodie's Experiments on Vegetable Poisons, in Philosophical Transactions. According to Robiquet, the essential oil of almonds does not, like

Two cases are said to have occurred at Montpelier, of children poisoned by the use of bitter almonds. In one, the person had eaten them after they had been heated in a copper vessel; and in the other, the child had been made to drink the milk, as a remedy against worms.*

Mertzdorff relates of a hypochondriac aged forty-eight years, who swallowed two drachms of the oil of bitter almonds. In a few minutes his servant, whom he called to his bedside, observed that his features became spasmodically contracted, and

common essential oils, exist ready formed in the almond, but is only produced when the almond pulp comes in contact with water. The principle, which acts on amygdaline, and when united to water produces the essential oil, he has recently denominated *Synaptase*. (*Journal de Pharmacie*, vol. xxiv. p. 326.)

According to Winkler's experiments, the product, by *distillation*, of bitter almonds and the leaves of the common laurel, is a hydruret of benzule, and which is comparatively innoxious; but at the same time an evolution of a cyan-benzule takes place, which is the cause of the oil of bitter almonds containing prussic acid, and which may be separated from it. (*London and Edinburgh Philos. Magazine*, vol. xi. p. 160. See also *Journal de Pharmacie*, vol. xxv. p. 189.)

This substance has peculiarly occupied the attention of chemists. Vogel and Robiquet, *Brande's Journal*, vol. xiii. p. 404, vol. xv. p. 155; *Annales of Philosophy*, vol. xi. p. 426; Wohler and Liebig, *London and Edinburgh Philosophical Magazine*, vol. iii. p. 389, vol. iv. p. 70; *Silliman's Journal*, vol. xxvi. p. 262; Robiquet, *North American Medical and Surgical Journal*, vol. x. p. 430; Goppert, *Edinburgh Medical and Surgical Journal*, vol. xxxv. p. 455; Geiger, Liebig, Wohler, Robiquet, and Boutron, *Journal de Pharmacie*, vol. xxi. p. 343; vol. xxii. p. 480; vol. xxiii. pp. 391, 503, 589.

Proctor's Observations on Amygdaline, and its existence in the Amygdalæ, (peach, nectarine, apricot, wild cherry, common cherry, etc.,) in *American Journal of Pharmacy*, vol. x. p. 188. Observations on Emulsine, in Dr. R. D. Thomson's *British Annual of Science*, 1839, p. 366.

Bernard on the action of Amygdaline and Emulsine, in *British and Foreign Medico-Chirurgical Review*, vol. v. p. 246.

* *London Medical and Physical Journal*, vol. xi. p. 92. A probable case of death, from eating bitter almonds, is given by Mr. Kennedy, in *ibid.*, vol. lvii. p. 150.

M. Chavasse relates of an individual seriously affected by swallowing half an ounce of the essential oil, (used by confectioners to flavor with.) Delirium and convulsions ensued, but soon ceased, on the use of emetics and stimulants. (*Lancet*, N. S., vol. xxiv. p. 930.) On this substance, see also Mr. Grindley, in *Pharmaceutical Journal*, vol. vii. p. 11; and Mitscherlich on the ETHEREAL Oil of bitter almonds, in *British and Foreign Medico-Chirurgical Review*, vol. vi. p. 276.

his eyes fixed. Insensibility soon ensued, with stertorous breathing, and the breath smelling strongly of bitter almonds. Death followed in thirty minutes from taking the oil. The body was examined in thirty-nine hours afterwards, and although the temperature had never exceeded 40° F., putrefaction was far advanced. The body was inflated with gas and the skin covered with bluish-green stains. Pure blood flowed from the mouth and nose, and the whole body had the odor of bitter almonds. The jaws were firmly fixed. The stomach and intestines were red, and checkered with bloody streaks, and in the former were six ounces of a brownish and highly odorous fluid. The liver, spleen, and kidneys were gorged with violet-colored fluid blood. The gall-bladder contained a violet-colored bile, and all the muscles had a similar tint. The lungs and heart were natural, but the latter was empty. The brain was everywhere tinged with the same sort of blood.*

In the case of a druggist who swallowed by mistake a quantity of the essential oil, M. Chavasse noticed early vomiting of alimentary matter and bile, which smelt strongly of prussic acid. The symptoms were deadly paleness, general coldness, a small intermittent pulse, convulsive movements, gay appearance and brilliancy of the eyes, and short and panting respiration. Convulsions successively occurred. Sulphate of zinc was given, which produced vomiting; hot cloths were applied, but, above all, reliance was placed on a mixture of brandy and ammonia diluted with water. Through these means his life was saved.†

Amygdalis persica. The kernels of the peach are very often distilled for the purpose of impregnating *eau de Noyau*, and if too strongly charged with the oil, it must prove noxious. The late Duke Charles of Lorraine nearly lost his life by swallowing a small quantity of this liquor,‡ and fatal cases are said to have lately occurred in England from the same cause.

* Edinburgh Medical and Surgical Journal, vol. xxii. p. 232. A case of suicide, with the oil, occurred in England, December, 1831.

† American Journal of Pharmacy, vol. xii. p. 172. A fatal case by Dr. Bull, is quoted in the Medical Times, vol. x. p. 524.

‡ London Medical Repository, vol. iv. p. 15.

Two fatal cases of poisoning with the peach-blossom are quoted from Coullon. The symptoms were violent purging, convulsions, and stupor. These are rather the symptoms of a narcotico-acrid.*

An oil is obtained by distilling its leaves or shoots.

Sorbus aucuparia. Mr. Grassman, of St. Petersburg, has ascertained that the flowers and bark contain more or less of the peculiar essential oil, which is procured from all the above vegetables.†

Carbazotic acid. This substance, procured by the action of nitric acid on indigo, is deemed a narcotic poison from the result of experiments on animals by Professor Rapp, of Tübingen. Its solution in doses of from ten to thirty grains destroyed them rapidly with convulsions and insensibility. No inflammation was seen after death, but many of the textures, as the lungs, conjunctiva, cellular tissue, etc., were dyed of a yellow color.‡

Nitrogen is classified by Orfila among the narcotic poisons. Animals, when plunged into it, experience a difficulty of respiration, which gradually becomes more rapid and weaker, but without any lesion of the nervous functions. Life is, however, readily restored by exposure to the atmosphere.

In Mr. Broughton's experiment on animals, death followed almost instantaneously from immersion into it. The right ventricle was distended with black blood, and the vessels of the brain, pleura, and lungs were collapsed.

Carbonic oxide. This forms a part as we have already stated, of the deleterious gases arising from burning charcoal. There are, however, one or two facts on record of its influence when prepared in the laboratory.

* Christison, p. 687.

† Ibid., p. 688. It is mentioned in the *Edinburgh Medical and Surgical Journal*, vol. xlix. p. 229, that Messrs. O. Henry and Boutron-Charlard have made a chemical analysis of the juice of the bitter yucca, and come to the conclusion that its poisonous principle is identical with hydrocyanic acid. I have already mentioned that Henry detected the same acid in the *Jatropha Manihot*.

‡ Christison, p. 690. Professor Hunefeld would seem to deny its poisonous qualities. It did not, with him, prove noxious. (*Edinburgh Medical and Surgical Journal*, vol. xxxvi. p. 460.)

Sir Humphrey Davy inspired it, in a state of mixture, with about one-fourth of common air. The effect was a temporary loss of sensation, which was succeeded by giddiness, sickness, acute pains in different parts of the body, and extreme debility. Some days elapsed before he entirely recovered.* Mistaken for arsenic in a case in London.†

Mr. Witter, of Dublin, desirous of fully ascertaining the effects of carbonic oxide, when freely inhaled, took three or four full inspirations of it. The consequence was an inconceivably sudden deprivation of sense and volition. He fell supine and motionless on the floor, and continued in a state of total insensibility for almost half an hour, and apparently lifeless, as pulsation was nearly extinct. Various restorative means were used without success, but on the introduction of oxygen gas into the lungs, he recovered, with convulsive agitation, excessive headache, and quick irregular pulsation; and for some time after mental recovery, total blindness, extreme sickness, and vertigo were experienced. An unconquerable propensity to sleep succeeded, after which he gradually recovered.‡

The following curious fact has also been considered as illustrative of the effects of the carbonic oxide. I quote it for its singularity, although I am not satisfied but that other causes may have aided in producing the disease:—

“The workmen of a cotton manufactory at Arques, near Dieppe, were attacked with nausea, vertigo, and convulsions, which so much affected their imaginations that they thought they saw spectres and other fantastic objects flying at them and seizing them by the throat. Mr. Nicolle, an apothecary at Dieppe, published a memoir on this disease, and he attributes it to the gaseous oxide of carbon, resulting from the decomposition of the oil, by the heat of a cast-iron stove, on which they were in the habit of placing their vessels of that fluid. This gaseous product being lighter than the atmosphere, would ascend, and in this way he accounts for the fact

* Davy's *Elements of Chemical Philosophy*, p. 172, American edition.

† Taylor on poisons, p. 217; *Med. Times and Gazette*, April, 1858.

‡ *Eclectic Repertory*, vol. v. p. 540.

that the persons in the upper stories of the manufactory were first affected, while those on the ground-floor were generally preserved from it.”*

Carburetted hydrogen. Sir Humphrey Davy, in attempting to breathe a mixture of air and carburetted hydrogen, was attacked with giddiness, headache, and weakness of the limbs. When he inspired it pure, the first attempt caused numbness in the muscles of the chest; the second induced an overpowering sense of oppression in the breast and insensibility to external objects; while the third seemed to remove all sensation, and the mouth-piece dropped out of his hand. On again becoming sensible, which happened in less than a minute, he continued to suffer for some time from a feeling of impending suffocation, extreme exhaustion, and great feebleness of the pulse.† In Mr. Broughton’s experiments with this gas on animals, the effects were extremely rapid, causing one or two gasps, stupor, and death. On dissection, black blood was found in the right ventricle, while the vessels of the brain were nearly empty, and the lungs collapsed.‡

Not long since, at Paris, in consequence of a leak in a pipe that carried the *gas-lights*, several individuals were attacked during the night with stupor, and if one had not been awakened by the smell and roused the rest, probably all would have perished. One person was comatose and occasionally convulsed, with froth issuing from his mouth, vomiting, stertorous breathing, and dilated pupils. Bleeding relieved him somewhat, but he died in six hours from the time of the alarm. On dissection, the vessels of the brain were found much gorged, the blood in the heart coagulated, one of the lungs congested, and its bronchial tube locked up by a kidney-bean.§ The cause of his death is therefore doubtful,

* Silliman’s Journal, vol. vi. p. 199.

† Christison, p. 703, from Davy’s Researches.

‡ Brande’s Journal, N. S., vol. vii. p. 14. It is curious, as suggested by Dr. Golding Bird, that the miners in coal mines, although breathing an atmosphere strongly impregnated with carburetted hydrogen, suffer no serious effects. Is there not some material difference between the natural and artificial gas?

§ Annales d’Hygiène, vol. iii. p. 457; Christison, p. 504.

but there can be no doubt that an atmosphere of it in a close room at night must be deleterious.

Mr. Teale has, however, published (1839) two cases, which are, without doubt, to be ascribed to the effects of this gas:—

Two females, a grandmother aged sixty-nine, and a granddaughter aged twenty-one, occupied apartments in Potter's Almshouses, at Leeds. A gas-pipe, situated about ten feet from the wall of their bedroom, and communicating with it readily, through loose earth and rubbish, was broken, and the smell of coal gas was generally perceived. An explosion took place in the evening in the pantry adjoining the bedroom, in consequence of a person entering it with a lighted candle. Under these circumstances, being assured by a person from the gas-works that no further danger was to be apprehended, the two females went to the same bed at half-past ten, and in the morning, at nine o'clock, (the doors having been broken open,) were found dead. The elder female was quite cold and stiff, but the trunk and extremities of the younger were warm. In about an hour, however, her muscles became rigid.

The appearances observed on each were very similar. The skin was generally pallid, except on the neck and back, which exhibited mottled discolorations of a florid hue. There was no swelling of the face or neck, nor any oozing of fluid from the mouth and nostrils. The muscles in each had an unusually light florid appearance, and there was a general absence of venous congestion. The right cavities of the heart were not distended, but contained a considerable quantity of florid fluid blood, (the color approaching more nearly to arterial than to venous.) The lungs were less crepitant than is natural. The bronchial membrane was red, and the mucous membrane of the small intestines injected in patches, so as to exhibit numerous minute ecchymoses. The stomach was healthy, and the brain but little loaded with blood.

The early occurrence of rigidity of the muscles is worthy of particular attention in these cases.*

* Guy's Hospital Reports, vol. iv. p. 106. I find that I have overlooked a case by Ollivier D'Angers, (*Annales*, vol. xx. p. 120.) A female was found dead in the morning in consequence of the chamber being filled with this

Nitrous oxide gas. Occasionally this gas has proved injurious to persons breathing it, and there is every probability of its being hurtful to such as have weak lungs. Chemists are hence unwilling to make it the subject of exhibition at the present day.

A case is mentioned by Mr. Stanley, in which the inhalation of this gas, probably somewhat impure from pushing the heat too high, (and hence diffusing some nitrous gas through it,) induced the most violent muscular motions at intervals, for half an hour, followed by great languor and fatigue.*

Cyanogen gas. Coullon found this to be very poisonous to the smaller animals, and the symptoms are coma, and more rarely convulsions. Hunefeld confirms these results. In the rabbit, slight convulsions, dilated pupils, and coma followed, with death in five or six minutes. Drs. Turner and Christison also found it very noxious to vegetables.†

Oxygen gas. When breathed in a state of purity, Mr. Broughton found that animals lived longer in it than in an equal quantity of atmospheric air; but if the experiment was continued for any length of time, hurried respiration and panting came on, then debility, slow inspiration, and insensibility. Examined in this state, the diaphragm was still, but the heart in action, and the peristaltic motion of the viscera maintained. The blood, both in the veins and arteries, was of a bright scarlet color. From these experiments, Mr. Broughton is induced to rank oxygen among the sedative poisons.‡

Hydrogen gas. It is doubted by many whether this should be deemed a poison. Sparrows and kittens immersed in an atmosphere of it, however, died in half a minute, and Mr. Broughton found the right ventricle distended with black blood, and the brain and lungs collapsed. Cardone's experiments on himself would also seem to render its dangerous nature probable.§

gas, passing through a crevice in the pipe. The body was already cold. The blood was fluid, and of a reddish-purple color. The right ventricle contained a small fibrinous clot, and the muscles had a red tint.

* *Lancet*, N. S., vol. xxxi. p. 395.

† Christison, p. 715.

‡ Brande's *Journal*, *ut antea*.

§ *Ibid.*, vol. xx. p. 394. The remarks of Raspail on the effects of gases

Carbonic acid gas and sulphuretted hydrogen gas also belong to this division of poisons. I have considered them in a previous chapter, and will only add that the antidote to the latter is chlorine. Chloride of lime in solution may, therefore, be employed.

on the human system are worthy of quotation: "When oxygen is not present, the animal dies for want of the combustion, that is, the oxygenation of the carbon of the blood. In pure oxygen it dies from the excess of this action. As to the other gases, they may be divided in this respect into two classes—the *asphyxiating* and the *deleterious*. The former are those which do not in any way alter the respiratory textures, and therefore kill the animal merely because they are not oxygen, such as *nitrogen, hydrogen, carbonic oxide, protoxide of nitrogen*, etc. The deleterious gases, on the other hand, are those that alter the textures, and are capable of killing or of injuring the animal, even when they are mixed with oxygen, such as *chlorine, iodine, arsenicated hydrogen, hydro-sulphuric acid, sulphurous acid, and even carbonic acid*, as was proved by Fontana, and is evinced by the observed fact that when an animal is asphyxiated by the effluvia of burning matter, it is violently convulsed if the air has been vitiated by burning charcoal; but, on the contrary, it sleeps quietly until it dies, if it be by coke that the air has been contaminated, for in the former case the product is carbonic acid, but in the latter a considerable proportion of carbonic oxide is formed." (Page 301.)

CHAPTER XXI.

NARCOTICO-ACRID POISONS.

Atropa belladonna—effects; atropine. *Datura stramonium* and other species—effects. *Nicotiana tabacum*—effects; juice; oil. *Conium maculatum*. *Cicuta virosa*, *maculata*. *Enanthe crocata*. *Æthusa cynapium*. *Chærophyllum sylvestre*. *Sium latifolium*. *Aconitum napellus* and other species. *Helleborus niger*. *Veratrum album* and other species. *Colchicum autumnale*. *Digitalis purpurea*. *Scilla maritima*. *Ipecacuanha*. *Ruta graveolens*. *Anagallis arvensis*. *Aristolochia clematis*. *Nerium oleander*. *Cerbera tanghin* and other species. *Apocynum*. *Asclepias*. *Cynanchum*. *Cissus*. *Mercurialis perennis*. Treatment. *Strychnos nuxvomica*—effects—appearances on dissection; strychnine—tests. *Strychnos Ignatii*.—Tieute. *Upas antiar*. *Ticunas*. *Woorara*. *Curare*. *Camphor*. *Cocculus indicus*: picrotoxine. *Coriaria myrtifolia*. Treatment. Poisonous mushrooms—symptoms—appearances on dissection—treatment. Ergot. Spurred maize. Diseased wheat. Darnel. *Lathyrus cicera*.—*Ervum ervilia*. *Cytisus laburnum*. Alcohol—symptoms—appearances on dissection—treatment. Sulphuric ether. Nitric ether. Chloroform. Essential oils—of cedar—of tansy—of savine, etc. Empyreumatic oils, creosote, etc. Sulphate of quinine. Unarranged vegetable poisons. Compound poisoning.

“NARCOTICO-ACRID poisons include those which possess a double action: the one local and irritating, like that of the irritants; the other remote, and consisting of an impression on the nervous system. Sometimes they cause narcotism, which is generally of a comatose nature, often attended with delirium; but in one very singular group there is neither insensibility nor delirium, but merely violent spasms. At other times they excite inflammation where they are applied. This effect, however, is by no means constant. Those which inflame the tissues where they are applied, rarely occasion death in this manner. Some of them may produce very violent local symptoms, but they generally prove fatal through their operation on the nervous system.”*

* Christison, p. 717.

Orfila divides this class of poisons into six groups, which may be stated here, although it must be added that they pass insensibly into each other, and therefore cannot sometimes be well distinguished.

1. Those whose principal symptom is delirium, as *atropa*, *datura*, *stramonium*, etc.

2. Those whose principal symptom is tetanus, as *nux vomica*, *strychnine*, etc.

3. Those which also excite convulsions, but at the same time cause impaired sensibility and sleep, as *Cocculus indicus*, *camphor*, *Upas antiar*.

4. Poisonous mushrooms.

5. Poisonous grain.

6. Alcohol, ether, and empyreumatic oils.

The individual substances to be noticed are the following:—

VEGETABLES.		
<i>Soloneæ</i> ,	<i>Rutaceæ</i> ,	<i>Menispermaceæ</i> ,
<i>Atropa</i> ,	<i>Ruta</i> .	<i>Cocculus</i> .
<i>Datura</i> ,	<i>Primulaceæ</i> ,	<i>Coriariæ</i> ,
<i>Nicotiana</i> ,	<i>Anagallis</i> .	<i>Coriaria</i> .
<i>Umbellifereæ</i> ,	<i>Aristolochiææ</i> ,	<i>Fungi</i> ,
<i>Conium</i> ,	<i>Aristolochia</i> .	<i>Agaricus</i> ,
<i>Cicuta</i> ,	<i>Apocynææ</i> ,	<i>Sclerotium</i> .
<i>Oenanthe</i> ,	<i>Nerium</i> ,	<i>Gramineæ</i> ,
<i>Æthusa</i> ,	<i>Cerbera</i> ,	<i>Lolium</i> .
<i>Chærophyllum</i> ,	<i>Apocynum</i> ,	<i>Leguminosææ</i> ,
<i>Sium</i> .	<i>Strychnos</i> .	<i>Lathyrus</i> ,
<i>Ranunculaceææ</i> ,	<i>Asclepiadeææ</i> ,	<i>Ervum</i> ,
<i>Aconitum</i> ,	<i>Asclepias</i> ,	<i>Cytisus</i> .
<i>Helleborus</i> .	<i>Cynanchum</i> .	
<i>Melanthaceææ</i> ,	<i>Ampelideææ</i> ,	<i>Alcohol</i> ,
<i>Veratrum</i> ,	<i>Cissus</i> .	<i>Sulphuric ether</i> ,
<i>Colchicum</i> .	<i>Euphorbiaceææ</i> ,	<i>Nitric ether</i> ,
<i>Scrophularinæææ</i> ,	<i>Mercurialis</i> .	<i>Chloroform</i> ,
<i>Digitalis</i> .	<i>Atocarpeææ</i> ,	<i>Essential oils</i> ,
<i>Asphodeleæææ</i> ,	<i>Antiaris</i> .	<i>Empyreumatic oils</i> ,
<i>Scilla</i> .	<i>Laurinæææ</i> ,	<i>Creosote, etc.</i> ,
<i>Rubiaceæææ</i> ,	<i>Laurus</i> .	<i>Sulphate of quinine</i> .
<i>Cephaelis</i> ,		
<i>Psycothria</i> .		

Atropa belladonna, L. (Deadly nightshade.) The berries of this plant are highly noxious. A detachment of several

hundred French soldiers, having halted at a short distance from Pirna, near Dresden, were allured by the inviting appearances of the berries of the atropa, which grew in abundance in the neighborhood. They accordingly ate freely of them, and one hundred and eighty men were thus poisoned, many of whom died before professional assistance could be rendered, and the rest were long in recovering.

The following were the symptoms, as related by M. Gaultier de Claubry, the medical officer in attendance: Dilatation and immobility of the pupils, total insensibility of the eye to the presence of external objects, or very confused and indistinct vision; the conjunctiva turgid with purple-colored blood; prominence of the eye, which in some appeared dull and heavy, in others bright and furious; great dryness of the lips, tongue, palate, and throat; deglutition difficult, in some cases nearly impossible; nausea, not followed by vomiting; sense of weakness, lypothymia, syncope; inability to stand upright; bending forward of the trunk of the body; continual movement of the hands and fingers; lively delirium, accompanied with a silly laugh; aphonia or inarticulate sounds uttered with difficulty; ineffectual inclination to intestinal evacuation; very gradual return to health and reason, without any recollection of the preceding state.*

In many other cases related by authors, most of the prominent symptoms mentioned above have been noticed.† Delirium of the agreeable kind, and dilated and insensible pupil, are the most invariable symptoms. After these, the most frequent are a dryness of the throat, constant motion of the extremities, and

* Orfila's Toxicology, vol. ii. p. 201; New England Journal, vol. iv. p. 92.

† Christison, p. 721. Sage saw fourteen children who had eaten of the berries. They could not swallow, and the pupils were immovable. They became drunk and furious, leaping and running. The one who had taken most, suffered under spasmodic twitchings, and discharged blood by the nose and anus, and vomited bloody and purulent matter. On recovering the power of deglutition, it was found that the whole roof of his mouth, his tonsils, and part of his tongue, were covered with aphthæ. They all survived, but on going to school four days thereafter, some saw red, others not at all, and none were able to articulate a sound. Of this they gradually recovered. (Edinburgh Medical and Surgical Journal, vol. ix. p. 380.)

locked jaw. Blindness often remains for some time.* In one case where forty-four grains of the powdered plant were taken by mistake, it was succeeded, among other symptoms, with extreme redness of the whole external surface exactly resembling that observed in scarlatina. Even the throat was of a deep red, and very painful and heated, and this sensation extended throughout the alimentary canal. Ineffectual attempts were made to evacuate the urine, which was red and bloody. It came away by drops. By soothing and antiphlogistic treatment, this dangerous condition was removed.†

It appears from a case related by Ray, that even the external application of the fresh leaf to the broken skin is not unattended with danger. The dilatation of the pupil of the eye, from the application of this substance, is well known, and has been extensively applied in modern surgery.

The watery extract of belladonna, when administered to animals, produced vomiting, dilatation of the pupils, delirium, and in general, the same course of symptoms as in man. The stomach was sometimes ulcerated or red, and at other times sound. The lungs and heart are occasionally livid.

The root of this plant is also poisonous. Indeed, Dr. Christison states, on the authority of Buchner, that it is the most active part of the plant. In one fatal case, where the individual died comatose twelve hours after eating the berries, an examination was made twelve hours after death. Putrefaction had commenced, the abdomen was swollen, the scrotum and

* Mr. Brumwell, in *Medical Observations and Inquiries*, vol. vi. p. 222. Mr. Smith, of Forres, Scotland, *London Medical and Physical Journal* for April, 1827. *Edinburgh Medical and Surgical Journal*, vol. xxix. p. 452, from *Journal de Chimie Médicale*. *Medico-Chirurgical Review*, vol. xxv. p. 528. Koestler, in *Burnett's Medical Botany*, vol. i. Dr. Underhill, in *New York Med. Gazette*, vol. i. p. 177. *Medical Times*, vol. x. p. 427. The sale of the berries, and the consequent use of them in tarts, etc., led to the case of poisoning which underwent a legal investigation at London, and the seller was found guilty of manslaughter. (*Lancet*, August, 1846.) Dr. Gray's cases, in *New York Journal of Medicine*, vol. v. p. 182. He mentions a symptom which deserves a further inquiry, viz., its great diuretic powers, after it has exercised its specific influence on the brain.

† Jolly, from *Nouvelle Bibliothèque Médicale*, 1828, in *Edinburgh Medical and Surgical Journal*, vol. xxxi. p. 225.

penis distended with fetid serum, the skin covered with dark vesicles, and the brain soft. The blood-vessels of the head were gorged, and the blood everywhere fluid and flowing from the mouth, nose, and eyes.*

Brandes was supposed to have discovered an alkaloid in this plant, which was styled *atropine*. It is now, however, considered as impure. The vapor of it was so injurious, producing violent headache, pain in the back, giddiness, and nausea, that he was obliged to discontinue his experiments. On tasting a small quantity of the sulphate of atropine, shaking of the limbs and oppression of breathing were induced, and even the vapor of this and the other salts were noxious. Six drops of the hydrate of atropine killed a bird, producing, previously, dilatation of the pupil and spasms, succeeded by stupor. On dissection, the head and lungs were seen gorged with black blood.†

Subsequently the same chemist has ascertained the presence of another organic base, and which is called *belladonnine*. This has a great analogy in its odor to ammonia. It is only slightly poisonous.‡

Geiger, Hesse, and Mein discovered the pure *atropine* in a solid form. The aqueous solutions of its salts exhale during evaporation a narcotic vapor, which dilates the pupil and causes sickness, giddiness, and headache.§

Runge has ascertained that alkaline solutions and lime-water so destroy or change the properties of atropine as to remove its power of dilating the pupil.||

In a fatal case, parts of the plant will undoubtedly be found

* Cases by Gmelin, Christison, p. 724. See also London Med. Gazette, vol. xix. p. 265. The medical extract is of course poisonous in large quantities. Mr. Clayton's case, in Lancet, N. S., vol. xxiii. p. 709.

† Annals of Philosophy, N. S., vol. i. p. 270; Burnett's Medical Botany. Geiger's experiments on it, in London Medical Quarterly Review, vol. i. p. 215. For an analysis of the atropa belladonna, by Vauquelin, see Philosophical Magazine, vol. xxxvi. p. 144.

‡ American Journal of Pharmacy, vol. xiii. p. 127.

§ Christison, third edition, p. 762. See also Bouchardat and Stuart Cooper's recent experiments with atropine. (Pharmaceutical Journal, vol. ix. p. 232.)

|| Brande's Journal, vol. xviii. p. 400.

in the stomach or intestinal canal, and may be recognized by their physical characters. These should be examined for atropine, and it has been suggested to boil down the stomach or intestines, and evaporate the aqueous solution. The extract may be applied to the eye to ascertain whether it produces its characteristic symptoms.*

Datura stramonium, L. (Thorn-apple, Jamestown-weed.) Its native country doubtful, but naturalized in every part of the United States. (Bigelow.) This plant has extended itself rapidly over various parts of our country, and is certainly one of the most offensive.† There are numerous cases on record of the poisonous effects of the leaves and seeds of it.

Dr. Barton states that in 1765, when some of the British troops under Sir John Sinclair were stationed in the vicinity of Elizabethtown, New Jersey, three of the soldiers collected a quantity of the plant, (which they mistook for lamb's quarters, *Chenopodium album*,) and dressed and ate it. One of them became furious, and ran about like a madman. The second was seized with genuine tetanus, and died.‡

Dr. Rush saw a child, between three and four years old, who had swallowed some of the seeds. A violent fever, delirium, tremors in the limbs, and a general eruption of the skin were present, accompanied with considerable swelling, itching,

* Burnett's Medical Botany.

† Dr. Barton remarks that it grows in great abundance about Vincennes, and was introduced there about the year 1785. "The plant, he adds, "is cut down by legal order, for the inhabitants assert that they were never affected with remitting fevers until the datura was introduced among them. The effluvia arising from the leaves, stem, and flowers are supposed to have given origin to the disease." (Barton's Medical and Physical Journal, vol. i. p. 145.) This is evidently laying too much on the plant, but its effluvia is certainly noxious.

Mr. Heckewelder, however, the Moravian missionary, in a letter to Dr. Samuel Cooper, says that he once lay in camp below the falls of Ohio, with Gen. Putnam and others, for several days. The ground was covered with stramonium in full blossom; its strong odor caused headache, and in some days he and Gen. Putnam had each a fever. The fogs of the river might have caused this, yet as he was accustomed to them, and had never been affected, he ascribes it to the scent of the plant. (Dr. Cooper's Dissertation on Stramonium, in Caldwell's Medical Theses, vol. i. p. 182.)

‡ Barton's Medical and Physical Journal, vol. i. p. 146.

and inflammation. Repeated emetics and purgatives, however, alleviated the disease, and brought away some of the seeds. Dilatation of the pupils, and blindness, still remained, but were obviated by a continuance of the previous remedies, and she recovered her health.*

In the Transactions of the College of Physicians of Philadelphia, Dr. Moses Bartram relates that he was called to a child suddenly seized with idiocy, without fever. The pulse was natural, tongue clean, and no internal function disturbed except those of the brain. The child appeared very happy, talking, laughing, and in constant motion, yet so weak that it could not stand or walk without tottering. He exhibited an emetic, and the seeds of the thorn-apple were ejected, after which the child recovered.†

* Transactions of the American Philosophical Society, vol. i. p. 384.

† Other cases are related by Dr. Fowler, Medical Commentaries, vol. v. p. 161. Here the face, eyes, and abdomen were swelled. The other symptoms were, however, similar to those mentioned in the text. By Dr. Thomas Young, Edinburgh Medical and Surgical Journal, vol. xv. p. 154. By M. Sarlandiere, Journal of Foreign Sciences, vol. i. p. 463. A fatal case by B. Granger, in a child two and a half years old. Convulsions and locked jaw, with insensibility, were among the latest symptoms. (Edinburgh Medical and Surgical Journal, vol. xvi. p. 155.) Another by Mr. Duffin, London Medical Gazette, vol. xv. p. 194. A case of recovery by James Johnson, Medical Facts and Observations, vol. v. p. 78. Case by Dr. Traill, in Christison, third edition, p. 769, who also gives additional references. Dr. Sigmond, Lancet, N. S., vol. xx. p. 327.

Several are quoted by Orfila from various authors. A remarkable case by Orfila himself, is given in the London Medical Repository, vol. xiii. p. 259, where it produced most of the symptoms of poisoning, but finally was the means of curing an intense and long-continued headache. A very interesting historical account of this plant, by Mr. Royston, is contained in the London Medical and Physical Journal, vols. xxv. and xxvi.

American Cases.

Dr. Brown, (New York Medical Repository, vol. v. p. 36.) A scarlet efflorescence was here present, and the pupils were dilated.

Two cases by Dr. De Witt, (ibid., vol. ii. p. 27.) In one instance the poison produced pain, and during recovery there were numerous vesications on the skin.

Dr. Beardsley, of Ohio, five persons with the usual symptoms. Dr. Drake's Tables, note, p. 69.)

Dr. C. D. Meigs. Here also, in a child, there was a very general efflo-

Orfila enumerates the following list of symptoms as produced by this plant: "Intoxication, delirium, loss of sense, drowsiness, a sort of madness and fury; loss of memory, sometimes transitory, and sometimes permanent; convulsions, paralysis of the limbs, cold sweats, and excessive thirst and trembling."

Dr. Drake, of Cincinnati, mentions that it is not uncommon, in the Western States, to observe hemiplegia, with spasmodic affections of the opposite side, in children who have eaten the seeds of flowers.*

The stramonium was some years since used to a considerable extent in asthma, and there is reason to believe that in some cases it proved deleterious.†

The tincture and decoction of this substance produce effects resembling those already described. Half a wineglassful of the former, after the common symptoms, caused violent con-

rescence, (small petechiæ.) (North American Medical and Surgical Journal, vol. iii. p. 33.)

Dr. R. E. Griffith, symptoms similar; but three days after eating the seeds, and when the patient was relieved from the immediate symptoms, a general eruption, resembling measles, broke out and continued twelve hours. (American Journal of Med. Sciences, vol. v. p. 251.)

Dr. Slavens of Kentucky, a case of attempted poisoning by a parent, first with the seeds and then with the decoction. Great torpor of the bowels ensued from the repeated doses. (Transylvania Journal, vol. iv. p. 172.)

Dr. Williams, of Ohio, a child delirious and deaf from merely chewing, not swallowing the seeds. (Western Journal of Medical and Physical Sciences, vol. viii. p. 165.)

Dr. Hooker, of New Haven, of a family poisoned by the leaves being boiled with greens for dinner. They all recovered. (Boston Medical and Surgical Journal, vol. xv. p. 60.)

Dr. Jones, American Med. Intelligencer, vol. iii. p. 245.

Dr. Millikin, Western Journal of Medicine and Surgery, vol. i. p. 211.

Dr. Spence, (three cases,) Boston Medical and Surgical Journal, vol. xxxi. p. 361.

Anonymous cases in Boston Medical and Surgical Journal, vol. ix. p. 10.

New York Journal of Medicine, 1856.

North Western Medical and Surgical Journal, vol. iii. p. 317. Case by Dr. Oatman. Raving, yelling delirium, blindness, and the other symptoms. A boy ate an apple: cured by emetics, castor-oil, etc.

* Drake's Tables, note, p. 69.

† See on this point, Dr. Bree's Letter on Stramonium, in New England Journal, vol. i. p. 411.

vulsions, lock-jaw, and stertorous breathing.* The extract, used as a suppository and introduced into the rectum, induced many of the symptoms of delirium tremens.† Even bruising the leaves in a mortar has caused dilated pupil and irritation of the skin.‡

In two fatal cases of children less than three years old, an examination was made. In one a large quantity of the seeds was found in the intestines; but no mention is made of any marks of irritation in them, or in the stomach. The bladder was distended, and the vessels of the pia mater loaded. In the other, where death followed in twenty-four hours, the brain was natural, the blood semi-fluid throughout the body, the stomach and intestines healthy, the bladder distended, the larynx and œsophagus slightly red, and the rima glottidis thickened and very turgid.§

The stomach of animals poisoned with the watery extract, by introduction into that organ, was found inflamed, and blood was extravasated between the mucous coat and the one subjacent to it. The lungs were of a deep red, and distended with black and fluid blood.||

The substance formerly announced by Brande as *daturine* is not now recognized as the pure alkaloid. Geiger and Hesse have obtained a crystalline substance of an acrid taste, which is probably the true *daturine*. The eighth of a grain killed a sparrow, and a small quantity applied to the eye occasioned great and permanent dilation of the pupil.¶

* Dr. Williams, in *New England Journal*, vol. xii. p. 253. Dr. Swaine, in *Edinburgh Physical and Literary Essays*, vol. ii. p. 272. Mr. Marsh, in *London Medical Gazette*, vol. viii. p. 605.

† *Medico-Chirurgical Review*, vol. vi. p. 493.

‡ Dr. Abel, in *Medical Recorder*, vol. xiv. p. 203. Very dangerous results have also been caused by applying stramonium ointment to an abraded surface. (*North American Medical and Surgical Journal*, vol. vi. p. 483, from *Journal de Chimie Médicale*.)

§ Mr. Granger, in *Edinburgh Medical and Surgical Journal*, vol. xvi. p. 155. Mr. Duffin, in *London Medical Gazette*, vol. xv. p. 194.

|| Orfila's *Toxicology*.

¶ Christison, third edition, p. 768. Dr. Morries found the empyreumatic oil of stramonium poisonous to animals. (*Edinburgh Medical and Surgical Journal*, vol. xxxix. p. 382.)

In a case occurring in India, Mr. Allan states that he obtained crystals of

The *Datura metel*, L., *ferox*, L., and *tatula*, L., are equally poisonous. The seeds of the *Datura metel* are used in Asia for their soporific and intoxicating qualities, and are made an instrument of unbounded libertinism.*

The *Datura arborea*, L., is another species that produces similar effects on the human system. Dr. Renton, of Madeira, relates several cases occurring in that island, from eating the seeds.†

Nicotiana tabacum, L. (Tobacco.) It is not necessary to multiply cases proving the poisonous nature of this substance when taken *internally*. The death of Santeuil, a French poet, was caused by an inconsiderate person emptying the contents of a snuff-box into his wine, which, as soon as he had swallowed, excited violent vomiting and excessive pain, and he died in fourteen hours.‡ So also when the infusion or the smoke is administered in large quantities, as by a clyster, convulsions, sickness, and vomiting supervene, and death is often the result.§

A female in London was persuaded by an empiric to use the infusion as a cure for worms. Soon after its exhibition as an enema she was seized with violent convulsions, and died in

daturine in the urine of the person poisoned, after death. (Lancet, September 18, 1847.) There is, however, a shade of doubt about this.

* Edinburgh Med. and Surg. Journal, vol. vii. p. 97, and Mr. Royston's paper. The Thugs are said to employ the pounded root of one of the species to induce stupefaction, and sometimes it proves fatal. (London Atlas, November 4, 1843.) The *Datura sanguinea* is used in Peru for similar purposes as the other species. (Tschudi's Travels, American edition, p. 188.)

† Edinburgh Medico-Chirurgical Transactions, vol. iii. p. 475.

‡ Orfila's Directions, p. 107. An individual swallowed two ounces of manufactured tobacco with an intention to destroy himself. It produced dilated and insensible pupils; cold extremities; scarcely perceptible pulse; cold, clammy sweats; stertorous breathing; spasms; jaws set. He was relieved by the stomach syringe and sinapisms. (Dr. Guy Wright, in Ohio Med. Repository, vol. i. p. 28.)

§ See some remarks on this point in the Edinburgh Medical and Surgical Journal, vol. ix. p. 159. A case where the smoking of tobacco produced most of the symptoms of apoplexy, as stertor, insensibility of the pupil, deep livid countenance, and spasmodic contraction, is given in the same work, vol. xii. p. 11.

fifteen minutes.* Another in Hamburg took an enema, consisting of an ounce of tobacco, boiled in water for fifteen minutes. In two minutes thereafter she was seized with vomiting, violent convulsions, and stertorous breathing. Death ensued in three hours after taking it.†

Externally, the effects are no less striking. A man and his wife fomented their bodies with a watery infusion of tobacco, in order to remove the itch. Giddiness, headache, retching, and vomiting, with diarrhoea, soon supervened. Thirst accompanied these, as also, spasms, and the debility and oppression were great. They were, however, gradually relieved by judicious treatment.‡ A liniment, prepared with the powder of tobacco and butter, applied to the heads of children laboring under tinea, caused vertigoes, violent vomitings and faintings, extreme perspiration, and a staggering walk.§

In a case where the expressed juice of tobacco, applied to the head of a boy for tinea capitis, proved fatal in three hours, the brain and viscera were found healthy, but the blood in the heart was fluid, with the exception of a coagulum in the right ventricle.|| In the case related by Dr. Grahl, there was, two days after death, great lividity of the back, paleness of the lips, and flexibility of the joints. The omentum very red, without gorging of its vessels; the small and great intestines, both outside and inside, gorged and red, and in some parts of the mucous membrane extravasated bloody patches. The other abdominal viscera natural, but their vessels were empty of blood. The stomach natural, the lungs pale red, the heart empty of blood, and the brain very natural.¶

Several experimenters have examined the effects of tobacco on animals. Fontana found that the insertion of the oil into

* North American Med. and Surg. Journal, vol. vi. p. 187.

† Case by Dr. Grahl, (from Hufeland's Journal,) Edinburgh Medical and Surgical Journal, vol. xxxvi. p. 237. See also Burnett's Medical Botany, vol. i.

‡ Medical Commentaries, vol. xi. p. 327.

§ Orfila's Toxicology, vol. ii. p. 214.

|| Case by Mr. Weston, from London Medical and Physical Journal, quoted in Coxe's Medical Museum, vol. iii., Appendix, p. 177.

¶ Edinburgh Medical and Surgical Journal, vol. xxxvi. p. 227. See also Edinburgh Med. Journal, 1855, 1856, vol. i. p. 643.

wounds induced temporary paralysis, but not death.* Brodie used both the infusion and the oil. The former when injected into the rectum of an animal, produced faintness, and early insensibility, and death. It stopped the circulation of the heart, and caused syncope. The latter excited violent convulsions, frequent respiration, and death, occasioning this termination by destroying the functions of the brain.†

The experiments of Orfila with snuff produced results generally similar to those we have now related, and they also show that the extract of the *Nicotiana rustica* acts in the same manner as tobacco, but is less active.

Vauquelin some years since analyzed tobacco, and found in it an acrid principle, which was styled *nicotine*. Subsequent investigations by Posselt and Reimarus have shown that this substance is the essential oil of tobacco, which is solid at ordinary temperatures, and they succeeded in obtaining another principle, which they deem the true nicotine.‡ [This is an oily, volatile liquid, at first colorless, but gradually becoming

* Medical Commentaries, vol. xii. p. 110; Philosophical Transactions, vol. lxx. p. 163. See also Dr. Morries' experiments, in Edinburgh Medical and Surgical Journal, xxxix. p. 383.

A boy, four years old, swallowed about a spoonful of oil of tobacco, collected from a pipe and put aside in a cup. Nausea, faintness, convulsions of the lower extremities, and insensibility of the pupil followed. An emetic was given, and this was succeeded by oatmeal gruel, containing some lemon-juice; the stomach was covered with warm cataplasms, and laxative enemata were administered. Under such treatment he recovered in twenty four hours, but was pale and without appetite for several days after. (Dersterberg. Encyclographie des Sciences Médicales, January, 1844. p. 14.)

† Eclectic Repertory, vol. ii. p. 274.

‡ Edinburgh Medical and Surgical Journal, vol. vi. p. 379; Christison, p. 728. See also a memoir on tobacco, by Dr. Conwell, in Philadelphia Journal of Pharmacy, vol. i. p. 104. Mr. E. Davy's experiments on nicotine, in Proceedings of British Association, 1835, Appendix, p. 38. O. Henry and Boutron-Charlard's experiments on the same. Journal de Pharmacie, vol. xxii. p. 689. Professor Mussey's essay on the influence of tobacco upon life and health. Boston, 1836. Zeise's experiments in Pharmaceutical Journal, vol. iii. p. 342. Barral's, showing it to be a liquid and extremely energetic. Melier and Bernard's, to the same effect. Bulletin de l'Académie de Médecine, vol. x. p. 593. Schloesing on the quantity of nicotine in the various kinds of tobacco. (Comptes Rendus, December 21, 1846.)

There is a curious bibliography of writers on tobacco, by Dr. Tabor, in Boston Med. and Surg. Journal, vol. xxx.

yellow, having an acrid, burning taste, a peculiar acrid odor, and a strongly marked alkaline reaction. It is inflammable, burning with a bright yellow flame. It is soluble in water, alcohol, ether, and the oils. Ether will take it from a watery solution. With acids, it forms deliquescent, and for the most part crystallizable salts. In its chemical habits it strongly resembles ammonia; thus, like ammonia, it gives a white precipitate with the bichloride of mercury, the acetate of lead, and the proto- and bichloride of tin. With the salts of zinc it gives a white, and with the salts of copper a blue precipitate, which is soluble in an excess of nicotine. It differs from ammonia in giving with watery solution of iodine a yellow precipitate—(with ammonia the color is discharged, and there is no precipitate)—and with pure tannic acid an abundant white precipitate. With ammonia a red color is produced, but there is no precipitate.

To ascertain the presence of nicotine in organic mixtures, these may be treated with cold water acidulated with strong sulphuric acid in the proportion of a drop to the ounce. After twelve hours' maceration, the liquid may be filtered and strained. The filtrate should now be reduced to one-half its bulk in a water-bath, and cold alcohol (95°) may be added in equal bulk. The precipitated organic matter is again removed by filtration, and the liquid again reduced to one-half its bulk by evaporation in the water bath. The acid liquor is now rendered alkaline by the addition of caustic potash or soda, and agitated with its bulk of ether. On being left to stand, the ether floating on the top will be found to contain the nicotine, and will yield it on evaporation.

In June, 1851, in Belgium, the Count de Bocarmé was condemned to death for poisoning his brother-in-law, Gustav Fougnyes, by means of nicotine. The poison was administered by force; the dose is unknown, and death took place within five minutes. M. Stas detected nicotine in the tongue, throat, stomach, liver, and lungs of the deceased.]*

Half a grain of the hydrochlorate produced violent nervous

* Orfila, fifth edition, vol. ii. p. 498.

symptoms, succeeded by insensibility for three hours, in an animal.*

Conium maculatum, L. (Hemlock.) Raving madness and epileptic fits occurred to Mr. Ray, in the case of a woman who had eaten the roots of this plant.† Vertigo, convulsions, coma, and death were the result to two soldiers at Waltham Abbey, in Essex, who had boiled it with their bacon for dinner.‡

Some soldiers partook of broth, into which hemlock had been put. All of them were shortly after seized with pains in the head and throat, and felt as if drunk; but the one who had eaten the most had laid down and gone to sleep. When first noticed, he was insensible, respiring with great difficulty; his pulse small and slow, even to thirty pulsations in the minute; the extremities were cold, and the face bluish, and distended with blood. An emetic was given without effect. He complained of being cold, but shortly after lost again the use of speech and sense, and died in three hours after taking the poison. On dissection, there were some red spots seen round the pylorus; the intestines were healthy, but all the vessels of the brain were gorged with blood, and on opening the cranium, there flowed out blood sufficient to fill twice an ordinary chamber-pot.§

Convulsions, furious delirium, and swellings of the face appear thus to be among the leading symptoms from the use of this poison.

There is, however, a case given by Dr. J. H. Bennett, manifesting an absence of the principal symptoms. A man ate a large quantity of hemlock, supposing it to be parsley. He soon lost power in walking, staggered, and finally fell. Both the upper and lower extremities became paralyzed, but he was able to answer a question put to him. This, however, also failed, but his pulse and breathing were natural. The pupils became fixed, the action of the heart was very feeble, and death followed in three and a quarter hours. Here there were no

* Philadelphia Journal of Pharmacy, vol. v. p. 201.

† Philosophical Transactions, vol. xix. p. 634.

‡ Ibid., vol. xliii. p. 18. Case by Mr. Watson.

§ Case by M. Haaf, quoted by Orfila. Toxicology, vol. ii. p. 242.

convulsions or raving delirium, while no medicine had been taken to counteract the symptoms.

On dissection, the brain was found healthy, but there was slight serous effusion, and an unusual quantity of blood flowed from the scalp. The lungs were gorged with dark-red fluid blood. The stomach contained a pultaceous mass, and its mucous coat was much congested, with numerous extravasations of dark-red blood, below the epithelium, over a space of the size of the hand. The intestines and bladder were healthy, but each presented patches of congestion. The blood throughout the body was dark colored and fluid.*

The juice, and the extract, when properly prepared, produce similar effects on animals. Orfila has, however, shown that the extract usually sold in shops is inefficient and weak.†

In a case examined by Drs. Christison and Coindet, where a hypochondriacal old woman took two ounces of a strong infusion of hemlock in whisky, early in the morning, fasting, and where death followed in an hour after, being comatose and slightly convulsed, the vessels of the head were not turgid, but the blood was everywhere fluid.‡

Brandes has obtained a peculiar alkaloid from the juice of the leaves of this plant, which is variously called *conine*, *conicine*, *conia*, or *coniin*. Half a grain will kill a rabbit, with tetanic symptoms resembling those produced by strychnine.§ Geiger, in further experiments, ascertained that the seeds, flowers, or fresh stems yielded a volatile alkali, analogous to that plant in tobacco. *The dry plant is almost destitute of it.* Coniin, as obtained by Geiger, is irritating to the eyes, causes

* Edinburgh Med. and Surg. Journal, vol. lxiv. p. 169.

† A drachm of the extract prepared by himself was sufficient to poison a dog, whereas an ounce, and even ten drachms, from several of the shops in Paris, produced no effect whatever. (Quarterly Journal of Foreign Medicine and Surgery, vol. i. p. 104.)

‡ Christison, p. 735.

§ Brande's Journal, N. S., vol. iii. p. 227. Tests of this substance have been proposed by Giseks. (North American Medical and Surgical Journal, vol. vi. p. 421.) For Battley's and Bird's experiments on *conium maculatum*, see American Journal of Med. Sciences, vol. ix. p. 506; vol. xii. p. 260.

giddiness, and indeed is so highly poisonous that one or two grains are sufficient to kill the largest animal.*

Dr. Christison, in a paper read before the Royal Society of Edinburgh, states that he had repeated the analysis of Geiger, and obtained precisely the same results. On birds it caused coma, convulsions, and depressed action, or even paralysis of the heart, while on the higher order of animals it is a local irritant, and its remote action is to cause a swiftly increasing paralysis of the muscles, ending fatally by asphyxia from palsy of the muscles of respiration. He also found this poison to be exceedingly active. Two drops applied to a wound, or introduced into the eye of a dog, rabbit, or cat, sometimes destroyed life in ninety seconds.†

[Conia is a straw-colored, oily liquid, volatile, strongly alkaline, soluble in alcohol and ether, and having a peculiar smell, which has been compared, when diluted, to that of mice. Its color is unaffected by sulphuric, nitric, or hydrochloric acid; with the vapor of the latter acid, the vapor of conia forms white fumes. The odor of conia readily distinguishes it from nicotina and lobelina, the only substances to which it bears any resemblance. It may be separated from organic mixtures in the same manner as nicotine.]

Cicuta virosa, L., or *aquatica*. (Water-hemlock.) This is a more violent poison than the preceding.

The following train of symptoms has been noticed: Dazzling, obscurity of the sight, vertigo, headache, often acute and excruciating, a vacillating walk, anxiety of the præcordia, cardialgia, dryness of the throat, ardent thirst, eructation, vomiting of greenish matter, frequent and interrupted respiration, tetanic contractions of the jaws, sometimes followed by lethargy, with

* British Association Report for 1831, 1832, p. 509. London Medical Quarterly Review, vol. i. p. 215. Researches on Conium, by Foderé. (Medico-Chirurgical Review, vol. xxiii. p. 218.) Philadelphia Journal of Pharmacy, vol. vii. p. 241.

† On the poisonous properties of hemlock and its alkaloid conia, by R. Christison, M.D., Professor. Professor Hunefeld has repeated and confirmed the above experiments, as to the rapidity of its action and its great power. (Medico-Chirurgical Review, vol. xlv. p. 252.) See also Christison, in Edinburgh New Philosophical Journal, vol. xxxviii. p. 354.

coldness of the extremities; at other times with a furious delirium, or attacks resembling epilepsy. In one or two cases a swelling of the face has been noticed. In a case where death followed, hiccough and fruitless efforts to vomit were present, with tetanic convulsions. The abdomen and face swelled after death, and there flowed a quantity of green froth from the mouth.*

The experiments of Wepfer prove how deadly this plant is to animals; and Linnæus, in his tour to Lapland, has illustrated it in an impressive manner. At Tornea, hundreds of cattle were annually destroyed in the spring, without any assignable cause. The poison was said to be of so pestilential a nature that though the animals were flayed before they were cold, yet wherever their blood came in contact with the human body, it caused gangrenous spots and sores. Some, indeed, had lost their lives in this way. On examining the meadow into which they were first turned out to graze, he found in it a bog or marsh, in which the *Cicuta aquatica* grew in great abundance, and had evidently been plentifully cropped by the cattle in feeding.†

In three fatal cases, the appearances on dissection were as follows: Bluish-red spots on the skin; pupils dilated; vessels of the conjunctiva gorged; lungs sound, but of a bluish-red color, and gorged with blood, as were also the vessels of the pleura. Blood in the right side of the heart. Brown spots on the mucous membrane of the stomach and small intestines, and these organs distended with gas. Epiglottis red, and much mucus in the trachea, and the vessels of the brain highly injected, as if they had died of apoplexy.‡

* Orfila's Toxicology, vol. ii. p. 248, collected from Wepfer, Guersent, etc.

† Linnæus' Tour in Lapland, London edition, vol. i. p. 245. See also vol. ii. pp. 136, 212. Cows eat it early in the spring, when its growth has just commenced; but as the summer advances, its scent becomes stronger, and warns them to avoid it. It is remarkable, however, that goats devour it with impunity. (London Medical and Physical Journal, vol. xii. p. 368.) This plant, according to Christison, would seem to be nearly as innocuous in Scotland.

‡ Medico-Chirurgical Review, vol. v. p. 505, from Journal Complémentaire, February, 1824.

In the instance of four children, (three, five, and six years of age,) who had eaten the root for parsnips, the youngest died in a few hours, with the usual symptoms. The others, as the nature of the poison was now discovered, were treated with emetics (which caused a rejection of portions of the root) and diluents, with warm applications. A decoction of nut-galls had been in the mean while prepared, and this was given frequently in divided doses. The three all recovered at the end of five days. Dr. Meyer, who was the attending physician, places great reliance on the nut-galls, or tannin, if that be preferred, as an antidote. In the above cases large quantities had been taken, and four hours elapsed before they were treated.*

Cicuta maculata, L. (Snake-weed, American hemlock, called Wild carrot, Wild parsnip root, Mock eel root, in Virginia.) A native of this country. We have, unfortunately, several cases on record of death produced by the root of this plant;† and from an examination of these, the following appear as the effects: Vomiting, pain in the bowels, tenesmus, and occasionally purging, convulsions, dilatation of the pupils, feeble pulse, and frothing at the mouth and nose, mixed with blood. When not convulsed, the patients lay in deep sleep; the countenance is pale, and the extremities are cold. Several observers have noticed an astonishing mobility of the eyeballs and eyelashes.

* Chemist, vol. iv. p. 133.

† New York Medical Repository, vol. xvii. p. 303, two cases by Dr. Ely, of Dutchess County, in this State. New England Journal, vol. vii. p. 219, case by Dr. Hazletine, of Massachusetts. Ibid., vol. iii. p. 334, by Dr. Stockbridge. Dr. Muhlenberg states, in a letter, that it had killed several at Harmony, Pennsylvania, who had eaten it instead of angelica. Medical Repository, *ut antea*. Three cases by Dr. Greenway, of Virginia, under the name of *Cicuta venenosa*, in the Transactions of the American Philosophical Society, vol. iii. p. 234. A case by Dr. G. W. Wright, Ohio Medical Repository, vol. i. p. 51. Cases in Boston Medical and Surgical Journal, vol. ix. p. 12, vol. x. p. 107. Two cases in Dunglison's American Medical Intelligencer, vol. ii. pp. 109, 157, by Drs. Cook and Lipscomb. I place both under this head, as I cannot find the *Cicuta virosa* credited as an indigenous plant to this country. One proved fatal. The symptoms in each were similar to those mentioned above, and particularly the epileptic convulsions. See also Bigelow's Medical Botany, vol. i. p. 129. There is scarcely a spring, that fatal cases from eating it through mistake are not mentioned in our newspapers.

although the pupils are firmly and widely dilated. Death follows rapidly, and particularly in children; in two cases within an hour after eating it.

In some instances, it kills without producing pain or convulsions. The Indians, when tired of life, are said to poison themselves with its roots.*

One dissection has been made by Dr. Hazletine. The limbs were more flexible than is usual. The stomach was inflated, and contained about three gills of a mucous, greenish fluid, on the surface of which was seen a part of the masticated root. There was no appearance of inflammation.

Önanthe crocata, L. (Hemlock dropwort, Dead tongue.) Several cases are on record of the poisonous effects of this plant. A citizen of the Hague ate, with one of his friends, some of its roots. In a short time they both felt a great heat in the stomach, which was followed by alienation of mind, vertigo, cardialgia, nausea, and diarrhoea. One of them had violent convulsions, the other bled at the nose; and the one who had eaten the most died at the end of two hours, and the other at the end of three.†

Eleven French prisoners, walking about the town of Pembroke, gathered and ate by mistake a small quantity of this plant, with bread and butter. One of them was shortly after seized with convulsions, and died in spite of every effort to save him. The others were attacked in a similar manner, of whom one died, and the others were relieved by forcing down an emetic. None experienced any heat at the stomach.‡

M. Charles visited a family who had eaten the roots of the *önanthe*. A sensation of burning was present in the stomach, and small rose-colored spots appeared successively in different parts of the body. The abdomen, in one case, was greatly swollen. Several soldiers are also said to have died from eat-

* Barton's Essay toward a *Materia Medica*, part i. p. 17.

† Stalpart, vol. i. p. 182. Our author quotes cases from Smetius Roeslerus, and Timæus, in which the root produced vertigo and violent delirium, and in some instances difficult respiration and hiccough.

‡ Howell, in *Phil. Transactions*, vol. xlv. p. 227, with the remarks of Mr. Watson.

ing them. The previous symptoms were nausea, vertigo, vomiting, and violent convulsions. Death ensued in less than an hour after using the poison. On dissection, the lungs were found distended, and their vessels full of black and dissolved blood; the bronchiæ, trachea, and mouth contained a frothy and whitish fluid; the stomach was contracted and inflamed in its extremity and lesser curvature, (its coats were thickened;) the intestines were puffed up, and their vessels injected. The derangements were precisely similar in all the cases; and the body of one, though preserved four days, exhibited no sign of putrefaction.*

Mr. Bossey has given a melancholy account of twenty-one convicts poisoned by eating the *cœnanthe*, of whom four died in less than two hours, (one indeed in three quarters of an hour,) and two after several days illness. Eleven more were sent to the hospital. The symptoms were of course exceedingly violent: strong convulsions, followed by extreme prostration, coma, and delirium. The mucous membrane of the stomach very red, and the blood was permanently fluid in the case immediately fatal. There was also extreme congestion of internal vessels.

Emetics, followed by venesection, to prevent over-distention of vessels, and the cold affusions, were found most useful by Mr. Bossey.†

"This seems," says Dr. Christison, "to be the most energetic of the umbelliferous vegetables. In none of the fatal cases was life prolonged beyond three hours and a half; and in several, death took place within an hour. One man was killed by a single spoonful of the juice of the root." It is, however, re-

* Duval, quoted by Orfila, *Toxicology*, vol. ii. p. 67. Additional cases are related by Dr. Vaughan, in *Philosophical Transactions*, vol. xx. p. 84; by Dr. Watson, in *ibid.*, vol. l. p. 856; and by Dr. Pulteney, *ibid.*, vol. lxii. p. 469; by Dr. Graves, *Medical Facts and observations*, vol. vii. p. 308; by Drs. Bry and Reveille-Parise, (*Journal Général*,) *London Medical Repository*, vol. xix. p. 434. In several of these, death followed in three or four hours. By Mr. Froyssell, *Lancet*, N. S., vol. xiii. p. 860; by Mr. Houlston, in his *Observations on Poisons*, p. 40.

† *London Medical Gazette*, vol. xxxiv. p. 288. See also Dr. Pickells, in the *Report of the British Association*, 1843.

markable, that Dr. Christison should at a subsequent period have found this plant, when growing in Scotland, to be inert.*

Enanthe fistulosa, L., has also frequently proved poisonous. "The *Enanthe phellandrium* is poisonous, but in a less degree." (LINDLEY.)

Ethusa cynapium, L. (Common fool's parsley.) This plant has been the cause of injury, from its being mistaken for parsley. Orfila gives the following as distinctive characters: 1. The leaves of the fool's parsley are of a blackish green on the upper side, and shining. 2. They have no smell without being bruised, but they give out a nauseous smell when rubbed between the fingers; parsley, on the contrary, presents an agreeable odor. 3. Its root is smaller than that of parsley, and dies every year, in autumn. Its effects are, heat in the throat, pain, cramps in the stomach, swelling of the body, and difficult respiration, drowsiness and starting; delirium is occasionally present. The symptoms are more violent if vomiting does not occur.†

Riviere examined a body poisoned by it. The tongue was black; a brownish serosity was found in the stomach, and the liver was hard, and of a yellow color.

Dr. Ficinus, of Dresden, has discovered an alkaloid in this plant, which is called *cynapia*, and by others *cynapin*.‡

Chaerophyllum sylvestre, L. (Wild chervil.) The root of this plant has produced delirium, profound sleep, numbness, and suffocation.

Sium latifolium, L. (Procumbent water-parsnip.) A native of the United States. This has also caused violent delirium, on eating the root in August; before that, it is not deemed noxious. Dangerous errors have been made from mistaking it for water-cresses, among which it grows. When not in flower,

* Edinburgh New Philosophical Journal, vol. xxxviii. p. 354. Pereira, in Pharmaceutical Journal, vol. iv. p. 17. See also Mr. Kesteven's Report on Toxicology, April, 1854; Taylor on Poisons, 715.

† Orfila's Toxicology, vol. ii. p. 250. Cases by Mr. Stevenson, London Medical and Physical Journal, vol. xiv. p. 425. Dr. Buckhave, in Medical Commentaries, vol. xiv. p. 37. Mr. Lowe, in Burnett's Medical Botany, vol. i.

‡ Philosophical Magazine and Annals, vol. ii. p. 392. British Association Report for 1831-2, p. 510.

they are much alike. The leaves of the parsnip are toothed at their edges; those of the other, undulated.*

The two following plants belong to the natural order of the *Ranunculacæ*, which are usually acrid in their properties; but Dr. Christison observes that they possess distinctly the characters of the narcotico-acrids, and I therefore place them in this class:—

Aconitum napellus, L. (Monkshood, wolfsbane, aconite.) Mr. Bacon, a surgeon, was called to visit a man named John Crumpler, who, at 8 P. M., had eaten some salad, in which, by mistake, a certain quantity of aconite had been put. The patient immediately felt a burning heat in the tongue and gums, and an irritation in the cheek. This tingling sensation extended over the whole body, accompanied with twitchings. When Mr. Bacon saw him, his eyes and teeth were fixed; his hands, feet, and forehead cold, and covered with a cold sweat. No pulse could be perceived, and his breath was so short as scarcely to be distinguishable. Oil and carduus tea were immediately administered, which induced vomiting, but the symptoms still remained aggravated. Ammonia was now given, when vomiting again supervened, accompanied with purging. His symptoms now improved, although the pulse was still interrupted and irregular; and he gradually recovered.†

Mathioli states that the root of this plant was administered to four highwaymen. Two of them, after having experienced the most violent pains, were saved by appropriate means; the other two died, one of whom, a few hours after administration, became an idiot; the face was covered with cold sweat; asphyxia, spasms, and syncope took place; he passed involuntary stools; vomited bilious and livid matter; his body swelled; and he died apoplectic.

Willis relates that a man died mad within a very short time after eating some salad in which there were some of the fresh

* Brande's Journal, N. S., vol. vi. p. 427.

† Philosophical Transactions, vol. xxxviii. p. 287. A fatal case, where convulsions followed the early symptoms, and where the aconite was mistaken for horseradish, is given by Dr. G. Smith, Forensic Medicine, p. 169, second edition.

leaves of the *aconitum napellus*. Even its juice, introduced into a small wound made into the thumb, has been known to give rise to pains in the fingers and arms, cardialgia, lipothymia, agitation, and, finally, copious suppuration and gangrene.*

A family near Lille were poisoned by this plant in consequence of a tincture of its roots being mistaken for that of a species of lovage. The usual symptoms soon followed, with swelling of the face, vomiting and purging. Two individuals died, and the only appearance of note was great redness of the inner membrane of the stomach and small intestines.† In some other cases observed by Pallas, the throat and rectum were also red; the lungs dense, dark, and gorged; and the cerebral vessels turgid.‡

It should be noticed that convulsions or spasm are not constantly present, nor is stupor.§ Dr. Copland, in his Dictionary, speaks of a case in which permanent paralysis, for two or three years, was induced.

Dr. J. C. Peters, in an analysis of numerous cases, seems to prove that the morbid appearances usually observed are congestion, and not inflammation of the brain, lungs, and liver,

* Orfila's Toxicology, vol. ii. p. 56. Mr. Brodie states that if a small quantity of the leaf of aconite be chewed, it occasions a remarkable sense of numbness of the lips and gums, which does not subside for two or three hours.

† Edinburgh Medical and Surgical Journal, vol. xxviii. p. 452, from *Journal de Chimie Médicale*.

‡ Christison, p. 741. A case of recovery, after taking a quantity of the tincture of *A. napellus*, is related by Mr. Sherwin. Emetics and venesection were the principal remedies. (*Lancet*, N. S., vol. xx. p. 13.) See also *ibid.*, vol. xxiii. p. 905. For an additional case, see *American Journal of Pharmacy*, vol. xii. p. 173, from *Journal de Chimie Médicale*, of a child aged twenty-two months, dead in a few hours from eating some leaves and two or three of the flowers of the plant. Pereira's *Materia Medica*, vol. ii. p. 1340, a man in London, aged fifty-seven, from eating some of the fresh roots at dinner. *Edinburgh Medical and Surgical Journal*, vol. lvi. p. 297. Twelve cases in Italy, from taking two ounces and upwards of the juice by mistake for that of scurvy grass. Three died and nine recovered. The symptoms and appearances on dissection agree with the statements in the text. (*Medico-Chirurgical Review*, vol. xlv. p. 264.)

§ Pereira's *Materia Medica*, vol. ii. p. 1340.

and redness of the mucous surface of the stomach and bowels, without inflammation.*

Effect on animals. Mr. Brodie injected an ounce of the juice of the leaves of aconite into the rectum of a cat. He soon voided it, and then stood motionless for some minutes. At the end of nine minutes he retched and vomited, and then attempted to walk, but faltered and fell at every step, as if from giddiness. At the end of thirteen minutes, he lay motionless, except some slight convulsive actions of the limbs; and in forty-seven minutes from the time of injection he was dead.† Orfila gave the freshly prepared watery extract to dogs, with similar effect. The posterior extremities were entirely paralyzed, and great pain seemed to be present. When, however, he used the extract purchased in the apothecaries' shops, it was slow in its operation, and required large doses to produce its usual effects.‡ The root of the plant also acts as a similar, and indeed more violent, poison to animals. Wepfer destroyed a wolf with two drachms of it; and Bonetus, with half a drachm, a young dog.

When applied to the cellular texture of animals, by Brodie and Orfila, the symptoms were very similar to those previously described. On dissection, the stomach and brain were generally seen healthy, although in a few cases the mucous mem-

* New York Journal of Medicine, vol. iv. p. 38. See also Dr. Fleming's Inquiry into the Properties of the *Aconitum napellus*, 1845.

† Brodie's observations and experiments on the different modes in which death is produced by certain vegetable poisons, from Philosophical Transactions of 1811; Eclectic Repertory, vol. ii. p. 273.

‡ Orfila's Toxicology, vol. ii. p. 52. This corresponds with the following fact, mentioned in a late journal: Ten patients, threatened with phthisis, were received into the hospital at Pavia, and the extract of aconite was prescribed for them. They took this to the amount of *half a drachm at a dose*, without any inconvenience, and indeed with improvement. All the extract, however, prepared in the hospital being consumed, a fresh quantity was procured from the shop of an apothecary, and administered in similar doses. Mental affections of the most alarming nature rapidly supervened, accompanied with other distressing symptoms. Borda prescribed laudanum as a *contra-stimulant*, and the patients were gradually restored. (London Medical Repository, vol. xv. p. 540. (See also Edinburgh Medical and Surgical Journal, vol. lii. p. 587.)

brane of the former was slightly inflamed. In another instance, the rectum exhibited a few reddish spots.

The *Aconitum cammarum*, Jacq., is said to be no less deleterious than the napellus, and cases of death from its use are related by Mathiolus and Bonetus. In an instance mentioned by the former, vertigo and violent commotion of the brain preceded a general swelling of the body; the countenance became livid, and the patient died in horrible convulsions.

The *Aconitum anthora*, L., and *Aconitum lycoctonum*, L., (Wolfsbane,) are also deemed poisonous.*

The *Aconitum ferox*, Wall., however, a native of the mountain ranges of Northern India, would seem to excel all the other species in virulence. Dr. Wallich says it is the *Vishavish* or *Bish* of the natives; and he observes "that this dreadful root is equally poisonous when taken into the stomach, or applied to wounds. It is in universal use for poisoning arrows." The Gorkhalese pretend that it is one of their principal securities against invasion from the low countries. In one tank of water destined for the use of a part of the British army, on a halt in pursuit of the retreating Burmese, the water had been poisoned by the *Aconitum ferox*, bruised and thrown in by the enemy before they evacuated the place. Undoubtedly fatal consequences would have ensued, had not Dr. Wallich discovered it.†

The Bish is also used in Northern India for destroying tigers. Arrows poisoned with it are shot at them, and they are soon found dead.

At the request of Dr. Wallich, who deems this substance equal in power to strychnine, Mr. Pereira performed some experiments with the root of the *Aconitum ferox*. The same numbness of the lips and tongue was experienced as from the

* Linnæus, however, mentions that he was informed by the wife of the principal clergyman of Lulea, that at a certain post-house in Lapland she had seen large quantities of the *Aconitum lycoctonum* collected and boiled for the use of the table, like cabbage! She was evidently acquainted with the plant. (Linnæus' Tour in Lapland, vol. ii. p. 123.)

† History of British India, (in Harper's Family Library, vol. iii. p. 127.) Dr. A. T. Thomson's Lectures, in London Medical and Surgical Journal, vol. vii. p. 292. Wallich, quoted in Journal Royal Institution, vol. i. p. 366.

napellus, on merely tasting the tincture. The poison was then exhibited to animals, either by the stomach, the cellular tissue, or the blood-vessels. The symptoms produced were difficulty of breathing, convulsions, and paralysis of the extremities. Death occurred rapidly, and on dissection, the right side of the heart was seen distended, and the left empty; the lungs of a florid red.*

According to Peschier, the *Aconitum napellus* contains a peculiar alkaloid, the *aconitine*, which possesses the poisonous qualities of the plant. His analysis, which at first was doubted, has been confirmed by Brandes and Geiger. It would appear to be highly poisonous. The one-fiftieth of a grain, dissolved in alcohol, killed a sparrow in a few minutes, and one-tenth of a grain destroyed a small bird with the rapidity of lightning.†

[The general use of the strong tincture of Aconite root as an external application has given rise to numerous cases of accidental poisoning. When taken in a poisonous dose, aconite produces a peculiar sensation of numbness, attended with pricking or tingling about the lips, mouth, and throat; the numbness and tingling afterwards often affect the extremities. There is a peculiar sensation about the throat, with burning pain, which extends to the stomach; vomiting, prostration, with small and frequent pulse, and great depression of the action of the heart. Convulsions and delirium are rarely present. In fatal cases death commonly occurs by syncope.

After the stomach has been relieved of the poison, the treatment consists in keeping the patient in a horizontal posture, in allaying the vomiting by the usual means, and in the

* Edinburgh Journal of Natural and Geographical Science, vol. ii. p. 435. For further information on the India Bish, I refer to Ainslie's *Materia Indica*, vol. ii. p. 40. (Transactions of the Medical Society of Calcutta, vol. ii. pp. 289, 410.)

† Duncan's Supplement, p. 2: (Lancet, N. S., vol. xiv. p. 113; Turnbull on Aconitine, in *Medico-Chirurgical Review*, vol. xxvi. p. 435. This substance has of late been employed for medical purposes in very minute doses, and some of the symptoms noticed are worthy of remark. Thus Headland (Lancet, Oct. 21, 1843.) states that an application to the surface causes tonsillitis, and internally, according to Copland, it induces hemorrhage from the fauces.

administration of stimulants. These last, when they cannot be retained by the stomach, should be given per anum.

Aconitine, the active principle of aconite, is one of the most deadly of poisons—one fiftieth of a grain, according to Dr. Pereira, having produced dangerous symptoms. It forms a whitish granular mass, almost insoluble in water, but soluble in alcohol, ether, and diluted acids.]

Helleborus niger, L. (Melampodium, Black hellebore, Christmas rose.) Morgagni mentions a case where an individual, under cure in the hospital, took about half a drachm of an extract made with water from the roots of this substance. He was seized with pain and vomiting, and died in eight hours. On dissection, the whole digestive canal was found inflamed, and the larger intestines more so than the smaller. There was, however, no gangrene, and the limbs continued flexible for some time after death.*

Two cases of poisoning with this substance have lately been communicated to the *Société Médicale d'Emulation*, at Paris, by M. Ferrary. A domestic took a decoction of the root in some cider, at the recommendation of an empiric, and his master, from curiosity, swallowed a like dose. In about three-quarters of an hour, alarming symptoms were developed, without, however, exciting suspicion of their real cause. Another glassful was taken by the servant, when vomiting, delirium, horrible contortions, accompanied with immediate coldness, supervened, and death at last ensued. The violence of the symptoms was proportioned to the quantity taken. The master died in two hours and a half, and the servant in one hour and three-quarters after its ingestion. On dissection, sixteen hours afterwards, the appearances in each were found precisely similar, except that in the domestic they were more strongly marked. The lungs were gorged with blood. The mucous membrane of the stomach was considerably inflamed, of a blackish-brown color, and reduced to an almost gangrenous state. The œsophagus and intestines were natural.†

* Morgagni, vol. i. epist. 59, p. 392.

† London Medical Repository, vol. x. p. 424. As this was a quack remedy, it is possible that some mineral poison may have been mixed with the hellebore.

In animals this produces vomiting, or attempts to vomit, great debility, vertigo, insensibility, and great torpor, and finally death. And this if the dose be large enough, whether taken internally or applied to a wound. The stomach and intestines, and particularly the rectum, are found inflamed, and in one instance the mucous membrane was ulcerated. Slight congestions have also been noticed in the lungs, and the bladder has been observed red and thickened.*

Helleborus foetidus, L., is also said to have caused the death of a child, who ate its root in the pulp of an apple.†

Helleborus orientalis, Lam. The hellebore of the ancients is also poisonous.‡

Chemists have not been able to detect an alkaloid in this plant. According to Fenuelle and Capron the active principle appears to be an oily matter containing an acid.§

Veratrum album, L. (White hellebore, Indian poke.) The root of this plant has long been distinguished for its poisonous qualities. Etmuller states that when applied to the abdomen, it produces violent vomiting; and the same phenomenon has been observed by Schroeder, when it was used as a suppository. Internally, it produces spasms, suffocation, loss of voice, and coldness over the body. Vicat relates the case of a family, who took some soup in which the root of white hellebore had been put instead of pepper. Shortly after, they were seized with a general coldness, and their bodies became covered with an icy sweat. Debility, and an almost imperceptible pulse

* Orfila's Toxicology, vol. ii. p. 7; London Medical Repository, vol. x. p. 426. A case of recovery is quoted by Dr. Christison which occurred to Dr. Fahrenhorst in Germany. A tablespoonful of the root in a fine powder had been taken. The symptoms were those of irritant poisons generally—burning pain in the stomach and throat, violent vomiting, to the extent of sixty times in two hours, cramps of the limbs, and cold sweats. Anodyne demulcents and sinapisms to the abdomen relieved the most material of these, and in four days the patient was well. (Christison, 3d ed., p. 786.)

† Orfila's Toxicology, vol. ii. p. 11. Additional cases are related in Burnett's Medical Botany, vol. i.

‡ A beautiful plate of this, from the Flora Græca, is given in Burnett's Medical Botany, vol. ii. plate 87.

§ Philosophical Magazine, vol. lx. p. 70; Brande's Journal, vol. xiii. p. 150.

succeeded, and they were not relieved until vomiting came on. The root, when powdered, is a powerful errhine.

In several instances collected by Dr. Christison, burning in the throat, gullet, and stomach, followed by nausea, vomiting, and dysuria, occurred very early, and these were succeeded by weakness of the limbs, giddiness, blindness, and dilated pupils, great faintness, convulsive breathing, and small pulse. In a fatal case quoted by Bernt, vomiting ensued, violent and incessant, and followed by death in twelve hours. On dissection, the gullet, stomach, and colon were here and there inflamed.*

When administered to dogs, it produced violent vomitings and debility, and when the œsophagus was tied there was violent straining, dejection, vertigo, and finally death. On dissection, the mucous membrane of the stomach was seen red, but not ulcerated. The other parts were natural. On inserting the root, in powder, into a wound on the thigh of a dog, similar symptoms were produced, accompanied with dilatation of the pupils, and the stomach, after death, presented the same appearance as in the previous instance.†

Veratrum viride (Aiton and Willdenow) is a native of New England, and is variously called American or Swamp hellebore, Indian poke, etc. It is said to have induced dangerous and even fatal effects. The root is bitter, nauseous and acrid, and burns the mouth and fauces.‡ A family in Bloomfield, Connecticut, were poisoned from its being mixed with greens for dinner. They, however, all recovered after vomiting, and the subsequent use of volatile stimuli.§

[In doses of from three to six drops of the saturated tincture, *V. viride* diminishes the frequency of the pulse in a very remarkable manner. In poisonous doses, besides its depressing effect upon the heart, it causes violent and protracted vomiting.]

* Christison, p. 746.

† Orfila's Toxicology, vol. ii. p. 3.

‡ New England Medical Journal, vol. iii. p. 335; Bigelow's Medical Botany, vol. ii. p. 125.

§ Boston Medical and Surgical Journal, vol. xviii. p. 259; see also Dr. Hubbard, *ibid.*, vol. xix. p. 31.

Although the presence of *veratrine* in this plant has been doubted, yet it seems to have been obtained by Mr. Worthington, in 1838.*

In the *Veratrum album*, in the seeds of the *Veratrum sabadilla*, Rets., and *Veratrum officinale*, Schiede., *Asagraea officinalis*, Lindley, and in the root of the *Colchicum autumnale*, L., Pelletier and Caventou have detected an alkaloid which they denominated *veratrine* or *veratria*. It is extremely bitter, and excites, even in minute doses, violent vomiting and purging. A few grains destroy the life of animals; and these effects, according to Andral, Jr., occur also when it is applied to the cellular tissue or thrown into the veins.† Within a short time, Courbè is said to have ascertained veratrine to be a compound substance, and a new alkaloid still more poisonous) and termed *colchicine* is announced by Geiger. One-twelfth of a grain produced salivation, diarrhoea, vomiting, tottering, convulsions, and death in twelve hours, when given to a cat. The stomach and bowels were violently inflamed, and there was an effusion of blood throughout their whole extent.‡

Colchicine autumnale, L. (Meadow saffron.) This plant acquired considerable celebrity some year since, from its being supposed to be the active ingredient in the *Eau médicinale* of Husson.

Its seeds have proved fatal to several children in consequence of eating them, and cattle also suffer greatly by them but only in the *spring*, when the seed vessel is fully matured. The seed, if swallowed, adheres to the coat of the stomach,

* Dr. Osgood, in American Journal Medical Sciences, vol. xiv. p. 297; Mr. Mitchell and Mr. Worthington's experiments, in Am. Journal of Pharmacy, vol. ix. p. 183; vol. x. p. 89.

† Brande's Journal, vol. x. p. 171; Edinburgh Medical and Surgical Journal, vol. xlii. pp. 156 and 235. There is a good paper on the vegetable alkalies by Dr. Peter, in the Transylvania Journal, vol. vii. p. 157.

‡ Lancet, N. S., vol. xiv. p. 118; Philadelphia Journal of Pharmacy, vol. vi. p. 320; Medical Almanac, 1836, p. 141. Courbè has also found another acrid principle in the *Veratrum sabadilla*, which he styles *sabadilline*, (Maugendie's Formulary p. 70;) and Merck has discovered an acid in it, the *veratric*. (London and Edinburgh Philosophical Magazine, vol. xv. p. 253; Journal de Pharmacie, vol. xxv. p. 295.)

and produces, at the several points of adhesion, spots of inflammation, which occasion the death of the beast.*

The following is an instance of its poisonous effects on man : An ounce and a half of the vinous tincture of colchicum was by mistake given to a feeble man aged fifty-six, and laboring under chronic rheumatism. No complaint was made until about an hour after, when retching and acute pains at the stomach came on, and vomiting and purging supervened. This state continued for nearly twenty-four hours, when the purging ceased, but the most distressing nausea continued, with frequent retching. The stools were, during the succeeding night, often involuntary, but not bloody. Excessive thirst came on, and continued till death, with severe pains of the stomach and bowels. In the evening, the patient seemed nearly exhausted ; delirium appeared ; the pulse could scarcely be perceived. He lived however, through the second night, but died the morning following. On dissection there was a redness of the stomach observed, but no appearance of inflammation in the bowels.†

In a case that occurred to Mr. Fereday, where two ounces of the wine of colchicum were taken through mistake, vomiting and purging, with violent pain, came on in an hour and a half. These continued, and resisted all means for their sup-

* Mr. Want, in the *Annals of Philosophy*, vol. iv. p. 281, from information communicated to him by Sir Joseph Banks and Mr. Andrew Knight. In the *Edinburgh Annual Register*, vol. vii. p. 114, it is mentioned that a farmer near Tetbury lost seven yearling beasts out of eighteen, by putting them in a pasture where this plant grew in abundance. On opening their bodies the food was found clotted together, in a crude and undigested mass, incapable of passing through the proper ducts. The French call it, among other names, *tue chien*, from its killing dogs.

† *Edinburgh Medical and Surgical Journal*, vol. xiv. p. 262. Some striking effects are mentioned by Dr. Schilling. A boy, six years old, on the 27th of June, 1836, ate some of the seeds and leaves. He was seized the same night with tetanic convulsions. Emetics were freely given with some relief, but on the 30th a spot appeared on the cornea, and on the 1st of July a capsular cataract was formed. This went off in two days, but hemiplegia succeeded, with convulsions and a constant diuresis. Various affections of the eyes followed in succession, and the patient finally sunk, after renewed convulsions, on the 14th of July. The diabetes begun twenty-four hours after taking the poison, and continued until death. (*London and Edinburgh Monthly Journal Medical Sciences*, vol. ii. p. 619.)

pression, for more than twenty-four hours, and the patient sunk in forty-seven hours after taking the substance. On dissection, the body, particularly in the front, was seen covered with patches of a purple efflorescence. The stomach and bowels were coated with a thick mucus, and a portion of the mucous membrane of the former was red, owing to a slight effusion of blood under it. There was a similar appearance in the peritoneum covering the jejunum. Lungs gorged with black blood, and which was effused under the pleura in spots. The heart was flabby, with black blood on the right side.*

A female took an infusion of colchicum to produce abortion. The symptoms were similar to the cases already related. The miscarriage took place the next day, and she died in a few hours after. On dissection, every part was found healthy except the mucous membrane of the stomach and intestines, and this was highly inflamed.† In a fatal case, Dr. A. T. Thomson found that every mucous surface of the body, even including the bladder, poured out quantities of blood. There was a general hemorrhagic condition.‡

* London Medical Gazette, vol. x. p. 161.

† Case by Mr. Dillon, in Burnett's Medical Botany, vol. ii.

‡ Lancet, N. S., vol. vii. p. 281. Some curious facts on the effects of climate on the properties of drugs, and colchicum in particular, are stated in Dr. A. T. Thomson's Elements of Materia Medica, vol. i. p. 72. Five fatal cases occurred at the Toulon Hospital. (Lancet, May 5, 1855, p. 474.)

Two cases of suicide with the wine of colchicum, committed successively by two sisters, are related by Drs. Caffé and Ollivier, (D'Angers.) There was violent pain, but no convulsions, nor were the pupils dilated. The only part cramped was the soles of the feet; violent vomiting, without diarrhœa, was present in both. They sunk in twenty-two and twenty-eight hours after taking the poison. The stomach of one was not inflamed, but its mucous coat was soft. The heart in both was filled with black coagulated blood. (Annales d'Hygiène, vol. xvi. p. 394.) In an instance related by Dr. McPhail, U. S. army, all the symptoms of Asiatic cholera were present from taking a pint of the wine of colchicum, (mistaken for Madeira,) and death ensued in forty-eight hours. Two individuals, engaged in the same drinking bout, suffered all the symptoms of dysentery, and died some weeks after. (Dunglison's Am. Med. Intelligencer, vol. ii. p. 312.) A fatal case, from a decoction of the seeds, by Dr. Neubrandt. (Edinburgh Med. and Surg. Journal, vol. liv. p. 262.) Another, from several ounces of the tincture, by Dr. A. T. Thomson. (London and Edinburgh Monthly Med. Journal, vol. iii. p. 537.)

[The poisonous properties of colchicum depend on the presence of a peculiar principle, colchicine, discovered by Geiger and Hesse. It is in white crystals, feebly alkaline in character, soluble in water, and having a bitter, acrid taste. In searching for this alkaloid, Taylor recommends the contents of the stomach, evaporated at a low temperature, to be treated with alcohol acidulated with hydrochloric acid. The alcohol is afterwards evaporated at a temperature not exceeding 100° F., until the liquor has attained the consistence of syrup. This is treated by water, and filtered. The salt is then decomposed by diffusing calcined magnesia through the water, and the colchicine is extracted by the addition of ether or chloroform, which yields it on evaporation.]

Digitalis purpurea, L. (Purple foxglove.) Dr. William Henry was called in October, 1809, to visit a female, an out-patient of the Manchester Infirmary, and laboring under dropsy, who had taken an overdose of the decoction of foxglove. It was prepared by boiling two handfuls of the leaves in a quart of water, and then pressing the mass, so as to expel the whole of the liquor. Of this, at 7 A.M., she drank two teacupsful, amounting in the whole to not less than ten ounce measures. Before eight she began to be sick, and vomited parts of the contents of her stomach. Enough, however, was retained to excite violent vomiting and retching throughout the whole of that and the following day, during which everything that was taken was instantly rejected. In the intervals of sickness she was excessively faint, and her skin was covered with a cold sweat. The tongue and lips swelled, and there was a constant flow of viscid saliva from the mouth. Very little urine was voided on the day she took the digitalis, and on the two following days the action of the kidneys was entirely suspended. When Dr. Henry saw her, which was forty-eight hours after she had taken the poison, the tongue was white, the ptyalism continued, though in a less degree, and the breath was fetid. The pulse was low, irregular, (not exceeding forty,) and after every third or fourth pulsation, an intermission occurred for some seconds. She complained also of general pains in the limbs, and cramps in the legs. By the use of effervescing draughts, and ether

with ammonia, she gradually recovered her imperfect health. Dr. Henry remarks that she had not taken any mercury, and that the ptyalism was entirely the effect of the digitalis.*

A man laboring under asthma imprudently took an ounce of the tincture of digitalis. He immediately fell asleep, and slept for three hours and a half. After this, on awakening, he vomited, and likewise had a motion. He then again slept quietly. A strong emetic was now given, which operated well, and he continued tranquil and his pulse regular. After two or three hours, however, his pulse began to intermit. Strong punch was given in divided doses, and also carbonate of ammonia. This supported the system, though the pulse was, at one period, as low as thirty-six in a minute. The intermission lasted for about twelve hours, and *the asthma was cured*.†

A quack was tried in London in 1826, for administering an overdose of digitalis. By his advice a young lad took, early in the morning, about six ounces of a strong decoction. Very soon afterwards, vomiting, severe pains in the bowels, and purging ensued. In the afternoon he became lethargic, and slept profoundly for several hours; but when he awoke, vomiting and pain returned. Convulsions ensued, with dilated and insensible pupil, and a slow, small, and irregular pulse, and in twenty-two hours from swallowing the drug, the boy died. On dissection, the internal membranes of the brain were found much injected with blood, and the inner coat of the stomach was red in some places. The other parts were healthy.‡

* Edinburgh Med. and Surg. Journal, vol. vii. p. 148. This symptom has been noticed by other practitioners. Dr. Barton mentions having seen it produced in a child from ordinary doses. (Barton's Med. and Physical Journal, vol. i. part i. p. 80.) Another case is related in *ibid.*, vol. i. part ii. p. 48. Dr. Barton quotes the following remark from Dr. Withering: "I am doubtful whether it does not sometimes excite a copious flow of saliva." (Withering's Tracts, vol. ii. p. 285.)

† Case by Dr. Fogo, in Edinburgh, Med. and Surg. Journal, vol. xviii. p. 345. A similar case is recorded by Dr. Beddoes, of an overdose taken by a dropsical patient. The vomiting was incessant. He was relieved by successive doses of opium. (Medical Facts and Observations, vol. v. p. 17.)

‡ Edinburgh Medical and Surgical Journal, vol. xxvii. p. 223. The prisoner was acquitted, on the ground that his advice had been asked. There is a parallel case in London Med. Gazette, vol. xxxiv. p. 559, by Mr. Wilson,

In France this substance is prescribed medicinally in very large doses, and instances of sudden death are hence not uncommon.*

Dr. A. T. Thomson asserts that foxglove acts powerfully in exciting the generative organs; and that one of the effects of an overdose is inflammation of the genitals, in both sexes.†

As an instance of its inertness I may add, that Dr. Robbins relates of an intemperate man, who, in a fit of passion, took half an ounce of the tincture. It remained on his stomach for one hour, without causing vertigo, affection of the pulse, or dilated pupil. At the end of that time an emetic was given with effect.‡

When administered to animals in the form of powder, or extract, or infusion of the leaves, it excites vomiting, anxiety, melancholy, smallness and slowness of pulse, involuntary stools, and convulsions; death closes the train of symptoms.§

Mr. Le Royer, some years since, obtained an active principle from the leaves of this plant, which he calls *digitaline*. A grain in solution, injected into the stomach of a rabbit, caused death in a few minutes, without agitation or pain. Similar effects were induced in larger animals by increased doses. || [Vegetable infusions containing tannic acid are said by M. Homolle to render *digitalis* inert.]

Scilla maritima, L. (Squill.) The root of this plant in over-

except that the patient, a robust young man, recovered by the aid of brandy and ammonia. His pulse for some time did not exceed forty strokes in a minute, and extremely weak.

* London Medical Quarterly Review, vol. ii. p. 454; Edinburgh Medical and Surgical Journal, vol. ii. p. 580; London Medical Gazette, vol. xxi. p. 581. A fatal case, from injection of the infusion of the leaves, is related in Edinburgh Medical and Surgical Journal, vol. lli. p. 586.

† Elements of Materia Medica and Therapeutics, vol. ii. p. 465.

‡ Boston Medical and Surgical Journal, vol. iii. p. 723.

§ Bonjean has made a number of comparative experiments with the powder of *digitalis*, its aqueous and its resinous extracts, and found all poisonous to men and dogs, and their power increases in the order just named. (Journal de Pharmacie, July, 1843.) But chickens were not affected by either. On the other hand, the East India Company's camels in Caubul are said to have been very numerously poisoned by this plant. (Chemist, vol. iii. p. 254.)

|| Brande's Journal, vol. xviii. p. 178. On the oil of *digitalis*, see Edinburgh Medical and Surgical Journal, vol. xxxix. p. 381.

doses causes sickness, vomiting, diarrhœa, and bloody urine. It likewise, according to Christison, produces narcotic symptoms. Lange mentions the case of a woman who died from taking a spoonful of the root in powder to cure tympanites. She was seized with violent pain, and died soon in convulsions. The stomach was found everywhere inflamed, and in some parts eroded. Twenty-four grains of the powder have proved fatal.*

When administered to animals, either internally or injected into the veins, violent efforts to vomit, dilated pupils, and lethargy were caused, and, in a few hours, convulsions and death.†

Vogel has discovered an acrid principle in the squill, denominated *scillitin*.

Ipecacuanha. This substance is obtained from several plants of the genera *cephaelis* and *psycotria*.‡ In itself, it can hardly be deemed poisonous, except in very large doses.§ But a very powerful alkaloid has been obtained from it by Pelletier, which is termed *emetin*.|| Two grains of this will kill a dog; and the symptoms are frequent vomiting, followed by lethargy and coma. Death ensues in fifteen or twenty hours, and the stomach and lungs are found inflamed.

* Christison, p. 744. In the case of a patient laboring under dropsy, who took a large quantity of vinous tincture of squills, probably equal to one hundred grains, extreme nausea and colic followed, and he died on the second day, probably from inflammation and gangrene of the bowels, but there was no dissection. Case by Dr. Wolfring, in *Chemist*, vol. iii. p. 318, from a German journal.

† Orfila's *Toxicology*, 3d ed., vol. ii. p. 202.

‡ See Abel's *Journey to China*, Appendix, p. 335; *Edinburgh Journal of Natural and Geographical Science*, vol. ii. p. 17. On the roots that yield the *ipecacuanha* of commerce, *Dictionnaire des Sciences Médicales*, vol. xxvi. Dr. Griffith, in *Philadelphia Journal of Pharmacy*, vol. iii. p. 181. *Lindley's Flora Medica*, p. 440.

§ In some constitutions, however, its effluvia induces difficult breathing, anxiety, and even spasms. A case is quoted from *Rust's Magazine*, where these were induced in a person from pounding the root during three hours. Vomiting and dangerous dyspnœa ensued, and these were relieved only by the use of active remedies. (*Lancet*, N. S., vol. viii. p. 38.)

|| The same substance has been found in the *Viola odorata*, L., by Boullay. (*Brande's Journal*, vol. xvii. p. 385.) See also *Brande's Journal*, N. S., vol. vi. p. 194; *Duncan's Supplement*, p. 58.

The same effects occur when it is injected into a vein, or applied to a wound.*

Of secondary consequence, but arranged in this group by Orfila, are:—

Ruta graveolens, L. (Rue.) The distilled water and watery extract, in large quantity, caused death in animals after a long interval, but its effects are not deemed powerful by Orfila. It would however seem, from some cases recently published by Dr. Helie, that the decoction of the fresh roots caused vomiting, great prostration, and delirium, and in two instances, inflammatory swelling of the tongue, with profuse salivation. It must, however, be observed, that in each of the three cases given by Dr. Helie, it was taken as an abortive, and proved such at intervals of from two to six days. Neither of the persons died.†

Anagallis arvensis, L. (Meadow pimpernal.) Naturalized in the United States. Its extract produces in animals dejection, insensibility, and death. The mucous membrane of the stomach and rectum was found inflamed, and the lungs livid.

Aristolochia clematitis, L. (Common birthwort.) Vomiting, convulsive motions, weakness of the posterior extremities, dejection, and death, were induced by its root. The stomach and rectum somewhat inflamed.

Nerium oleander, L. (Common oleander, Rose-bay.) The extract of this plant produced in animals vomiting, vertigo, weakness of the extremities, convulsions, and death. The distilled water and powder are less active. The digestive canal was not affected.

Morgagni (who also called this plant *Rhododaphne*) relates the case of a female who drank some of the juice. Vomiting soon succeeded. Her lips were brown; the pulse small and weak; and power of speech was lost, and she lay insensible. Death ensued nine hours after taking the juice. On dissection, the back of the body was universally of a violet color, but the anterior natural. There was some heat of the body,

* Magendie. The decoction of nut-galls is the antidote to emetin, according to Devergie.

† Annales d'Hygiène, vol. xx. p. 180.

though seventeen hours had elapsed since death; the blood-vessels of the stomach, intestines, and omentum were much distended; the stomach contained a greenish fluid, but its membranes were sound; the right lung was red and adhering, while the left was completely collapsed. All the other viscera were natural.*

Tanghinia veneniflua. Boyer. *Cerbera tanghin*, a native of Madagascar, and where the seeds are said to be employed as an ordeal for the detection of persons accused of crimes.† According to the experiments of Dr. Ollivier, of Angers, it produced in animals vomiting, great weakness, dilated pupils, convulsions, succeeded by lethargy. Mr. Henry has obtained from it a white and crystallizable substance, to which the acrid properties are attributed; and another, styled *tanguin*, to which the narcotic symptoms are to be ascribed.‡

* Morgagni, vol. iii. p. 387; Orfila's Toxicology, vol. ii. p. 259. The *Nerium odorum*, Aiton, has its root poisonous, and "is but too often resorted to for the purpose of self-destruction by the Hindoo women when tormented with jealousy." (Ainslie's *Materia Indica*, vol. ii. p. 23.)

The *Nerium oleander* abounds in the north of Africa. A small detachment of the French army of Algiers halted near the branches of a river where this tree was very common. The cook of the party was advised to stir the barley that he was preparing for their meal with a branch of it. Five men who ate of this food were seized with symptoms of poisoning—vomiting, spasms, or stupefaction, dilated pupils. They, however, recovered after an interval of some days, but needed active treatment. (Du Barry, *Encyc. des Sciences Médicales*, October, 1843, p. 144.)

† Loudon's *Magazine of Natural History*, vol. vi. p. 264. Under the name of *Cerbera tanghin*, Mr. Telfair, in a letter from the Mauritius, dated March 8, 1829, gives an interesting account of this substance. It is not much larger than an almond, yet it is sufficient to destroy twenty persons. He was present on an occasion when it was given to the servants of the King of Madagascar, on a suspicion of his having been poisoned. The kernel was pounded fine with a stone, and every one was made to swallow a portion of it. On some it began to act in half an hour or less. Those whose stomachs reject it early generally recover. On this occasion there were only two individuals in whom this was the case. The others were thrown, in a state of insensibility, into a hole, and every person present was obliged to throw ground over them, so that the burial was quickly completed. Radamo abolished the use of this as an ordeal. (*Transylvania Journal*, vol. iii. p. 420, from Curtis' *Botanical Magazine*, February, 1830.)

‡ Orfila's Toxicology, 3d ed., vol. ii. p. 338; *Bulletin des Sciences Méd.*, vol. iii. p. 80.

Cerbera ahovai, L. Its nut is highly deleterious, and the wood, when thrown into the water, intoxicates fishes. The *Cerbera manghas*, L., is equally so. A Javanese woman, says Dr. Horsfield, swallowed, out of curiosity, about a scruple of the external part of the fruit; it produced partial delirium, and temporary blindness, but she retained the power of speech.*

Cerbera thevetia, L., is a native of Guadaloupe, and, according to Dr. Ricord Madiana, its seeds operate similarly on animals. In large doses it caused death; and on dissection, the head and stomach were found much injected with blood.†

Several species of *Apocynum*, as the *androsæmifolium*, *cannabinum*, and *venetum*, furnish an acrid milky juice, which inflames and ulcerates the skin. The first and second of these are American plants.

Asclepias gigantea, L. Bauhin asserts that the juice of this, given in a dose of a drachm and a half, has produced violent symptoms and a fatal hemorrhage. When Orfila administered to dogs the *Asclepias vincetoxicum*, L., the animals died at the end of one or two days, and their stomachs were found inflamed.

Cynanchum erectum, L. (*Pergularia erecta*, Spreng.) Plenck relates that thirty-six grains of the leaves of this plant, administered to a dog, produced violent vomiting, a trembling, convulsions, and death. The *Cynanchum viminale*, L., (*Sarcostemma viminale*, R. Br.,) furnishes a milky juice, extremely caustic.

Cissus glandulosa, Gmel., and *quadrangularis*, L., (*Sælanthus glandulosus* and *quadragonus* of Forskal,) are acrid, and, according to Orfila, poisonous.

Mercurialis perennis, L. (Mountain mercury, Dog's mercury.) This plant is hurtful to both man and animals. It causes vomiting, diarrhœa, profound sleep, and convulsions. Ray relates the case of a man, his wife, and three children, who experienced deleterious effects from eating it fried with bacon.‡

* Ainslie's *Materia Indica*, vol. ii. p. 262.

† *Annals of the New York Lyceum of Natural History*, vol. i. p. 86.

‡ *London Med. and Physical Journal*, vol. xv. p. 71. The case of a family

An Irish female at Boston, mistaking this for a green, common in her own country, cooked it as such. In half an hour it caused delirium, stertorous breathing, and coma. An emetic of sulphate of zinc, however, relieved her.*

The treatment of the poisons enumerated until now in this chapter resolves itself into an endeavor to remove the noxious substance by emetics or the stomach-pump. Enemas are also advisable, if the poison has been retained any time, to procure its discharge by the bowels. If symptoms of cerebral congestion supervene, venesection is advisable, and afterwards diluted acidulated drinks, frequently repeated. Inflammation is to be met by its proper remedies.†

In the comatose state, which is apt to accompany several of these, and when the remedies above prescribed are apparently ineffectual, individuals have occasionally been roused by the use of diffusible stimuli. Thus Dr. Sigmond advises, in this stage of poisoning from stramonium, cold affusions to the head, and an enema containing some ten grains or less of *camphor*.

Dr. Hubbard mentions several instances of narcotic and narcotico-acrid poisoning of this description, where the exhibition of *sulphuric ether* in considerable quantity revived the patient from an apparently desperate state, and permitted the subsequent successful application of the usual remedies.‡

poisoned by it, (of whom some died,) is mentioned in the Philosophical Transactions, vol. xvii. p. 875.

* Boston Medical and Surgical Journal, vol. iii. p. 358.

† Orfila's Toxicology, 3d ed., vol. ii. p. 200.

‡ Boston Medical and Surgical Journal, vol. xix. p. 31. A curious case is related by Dr. Walker, in the Philadelphia Medical Examiner, (vol. iv. p. 742,) where the patient took by mistake twenty grains of the extract of belladonna, combined with the compound camphorated liniment. It was intended as an external application. The last portion taken, at the end of twelve hours, excited vomiting, but there was no other subsequent bad symptoms. The extract was ascertained to be of good quality, and it is therefore suggested by Dr. Walker that the ammonia in the compound may have proved an antidote.

In a still later case, where a child, aged eleven years, was poisoned by a strong decoction of the leaves of belladonna, and where emetics and other remedies had little effect, Dr. Verdier found immediate relief from the use

We come now to a class of narcotico-acrids which induce violent tetanic spasms, without impairing the sensibility, but, on the other hand, heightening it. They have also local irritant properties, although these are seldom observed, on account of the rapidity of their deleterious action. And in consequence of this last, but few morbid appearances are noticed.*

Strychnos nux vomica, L. A native of Ceylon and the coasts of Coromandel and Malabar. The seed, commonly called *nux vomica*, is the part of the plant usually employed. It has of late years been frequently used in cases of suicide, and a narrative of its effects is therefore necessary.†

Mr. Ollier saw a young woman who, in a fit of melancholy, took nearly half an ounce. Half an hour after she was found by him calm and well. He went away in search of an emetic, and on his return found that slight convulsions had occurred. These increased rapidly in frequency and violence, darting out the extremities, and stiffening the body. In the short intervals she was sensible, but had a feeble pulse, and complained of sickness and great thirst. She died in an hour after swallowing the poison.‡

A young lady took by mistake a tablespoonful of the powder of *nux vomica*. She was instantly deprived of the power of walking, and fell down, but without losing her recollection. Dr. Basedow, of Merseburg, saw her immediately. The pupils were contracted, pulse small, and skin cool. The forearm was half bent, and the hands and fingers had convulsive twitches. The legs were rigid, and all the muscles tetanically contracted. She had not the slightest pain or sickness, but her breathing became every moment more difficult, and she complained of impending suffocation. She was gradually relieved by an emetic, and small doses of oil of turpentine and sulphuric

of enemas of coffee, containing twenty drops of ammonia. The delirium was subdued, and the patient gradually recovered. (*Encyclographie des Sciences Médicales*, February, 1844.)

* Christison, p. 750.

† This poison seems to have been known in the time of Valentini. See his *Pandects*, vol. i. p. 622. *De nuce vomica penes furem deprehensa*.

‡ London Medical Repository, vol. xix. p. 448.

ether. The dyspnœa gradually subsided, and toward evening the tetanic spasms had ceased.*

These instances, one of death and the other of recovery, might be multiplied, but they are sufficient to give an idea of the usual symptoms.† It would appear that in smaller doses the effects are more distinctly those of the narcotico-acrid poisons. Heat and burning in the stomach, stiffness of the joints, convulsive tremors, and at last violent fits of tetanus were noticed in a case where about a drachm had been taken. To this followed redness and inflammation of the tongue, burning thirst, pain in the stomach, and hot skin. Next day, though the fits had ceased, the muscles were very sore, especially on motion. Colic and diarrhœa, with vomiting, occurred; but on the fourth day they disappeared and she became convalescent.‡

Its action on the paralytic is striking. A patient at the Hôpital Saint Louis, in Paris, laboring under hemiplegia of the right side, took twenty-four pills of it. He would have suffered severely, if proper remedies had not been instantly administered; but the convulsions, which always accompany this poison, continued, and afterwards affected only the diseased part, so that the arm which before was lifeless, was now strangely and constantly agitated.§ [A collection of cases of poisoning by *nux vomica* has been made by Dr. Husemann, in Reil's *Journal für Toxicologie*, 1857.]

* Edinburgh Medical and Surgical Journal, vol. xxxi. p. 445.

† Other cases are given in Christison, p. 754, etc. London Med. Gazette, vol. iii. p. 445, by Mr. Baynham. Edinburgh Medical and Surgical Journal, vol. xxxv. p. 451, by Mr. Watt, (from Glasgow Medical Journal,) Lancet, vol. x. p. 732.

‡ Tacheron, Medico-Chirurgical Review, vol. iv. p. 500. It is singular that the natives of Hindostan use this substance for many months continuously, beginning with a small quantity, and increasing sometimes to twenty grains, without any bad effect, provided it be not taken on an empty stomach; if this be neglected, spasms are apt to ensue. The nut is taken in its natural state, or half roasted. The seeds are employed in the distillation of country spirits, to render them more intoxicating. (Baker, in Transactions of Med. and Physical Society of Calcutta, vol. i. p. 138.)

§ London Medical Repository, vol. vii. p. 163.

Appearances on dissection. In Mr. Ollier's case, the parts were almost natural; the brain somewhat congested, and the heart empty. In a dissection by Orfila and Barruel, where death was also speedy, the spinal plexus of veins was slightly gorged, the pia mater red and injected, and the cerebral substance soft, and presented a number of bloody spots on cutting into it. The spinal marrow was natural; the mucous membrane of the stomach and intestines blanched; but here and there on the former a red patch. Lungs gorged with black fluid blood.*

According to the time that elapses before death, will be the marks of inflammation in the stomach and intestines. This is shown by comparing the dissections mentioned by Christison.† “Defermon described,” says Magendie, “and I have myself seen, a contracted state of the spleen, consequent on poisoning by this substance.”‡

No poison has been more repeatedly made the subject of experiment than the *nux vomica* and the alkaloids found in it. These were discovered by Pelletier and Caventou, and are denominated *strychnine* and *brucine*. The effects of the first are by far the most rapid and violent. Magendie killed a dog with one-eighth of a grain, and the editor of the *Edinburgh Medical and Surgical Journal* says that he has himself seen one die in two minutes after the injection of one-sixth of a grain.§ “There is little doubt,” says Christison, “that half

* *Lancet*, vol. viii. p. 56, from *Archives Générales*. See also Orfila, *Leçons*, third edition, vol. iii. p. 443, for additional dissections.

† Christison, p. 727. See also several cases, mentioned by Sir James Clarke in his work on *Climate, Disease, etc.*, p. 140.

‡ Magendie's *Formulary*, p. 2.

§ Among the experimenters on *nux vomica* and *strychnine*, I may enumerate Magendie and Delille, *Eclectic Repertory*, vol. iii. p. 274; Segalas, in *London Medical Repository*, vol. xxv. p. 552, vol. xxvi. p. 61; Somerville, Harlan, Coates, Lawrence, and Hubbard, in *Chapman's Journal*, vol. ii. p. 192, vol. iii. p. 296, vol. iv. p. 242; Dr. A. T. Thomson, in *London Medical Gazette*, vol. viii. p. 50; Review of Bardsley on *Strychnia* and *Brucia*, *Edinburgh Medical and Surgical Journal*, vol. xxxiii. p. 406; Dr. Booth, in *Transactions Provincial Med. and Surgical Association*, vol. ii. p. 221; Dr. Stannius, *British Annals of Medicine*, vol. ii. pp. 144, 176. See also, *Annals of Philosophy*, vol. xvi. p. 28; Brande's *Journal*, vol. vii. p. 375; *Edinburgh Med. and Surg. Journal*, vol. xviii. p. 159; vol. xix. p. 495.

a grain, thrust into a wound, might kill a man in less than a quarter of an hour."

A single grain was taken by mistake by an individual, and produced the usual tetanic symptoms; after an emetic, sulphuric ether was given in successive doses, and subsequently a mixture of ether and oxide of zinc. He recovered. Another case was a fatal one, two scruples having been swallowed. Death succeeded in an hour and a half after the suicidal act. On dissection, the body was found extremely stiff. Two quarts of fluid blood escaped from the vertebral canal on opening it. The blood-vessels of the head were congested, and the upper part of the spinal marrow was softened. The stomach was healthy.*

[The frequency with which, of late years, strychnine has been used in criminal poisoning, demands a more detailed notice than given by Dr. B. In poisonous doses it causes tetanic spasms, lasting but a short time, but recurring at brief intervals. During the spasm the legs are extended and separated, the head and trunk bent backwards, the feet incurvated the hands clenched, and the arms sometimes extended; occasionally the forearm is bent upon the arm. Just previous to the paroxysm, there is a sense of suffocation, with twitching and trembling of the limbs. The paroxysms vary in length from a half to several minutes. During their continuance the pulse is very rapid, and in the interval the body is commonly bathed in perspiration. Between the paroxysms the patient is usually able to speak and swallow, and the intellect is clear. The symptoms commonly supervene within half an hour of the time the poison is swallowed, but they make their appearance within a few minutes, and in one instance they were delayed for two hours and a half.† If the patient survive two hours

* British Annals of Medicine, vol. i. p. 339; Lancet, N. S., vol. xxi. p. 647. See also Dr. Wilson's case, in London and Edinburgh Monthly Journal, December, 1845.

Instances are multiplying of the dangerous and fatal effects of applying strychnine and its salts to the skin in too large quantities, (*endermically*, as it is styled.) See Magendie and Guthrie, in Lancet, N. S., vol. xv. pp. 117, 321.

† Edinburgh Medical Journal, 1848, p. 566.

from the commencement of the symptoms, he commonly, but not invariably, recovers. Death may take place during a paroxysm from suffocation, or after it from exhaustion. The smallest fatal dose on record is half a grain, though this is an extreme instance.]

The effects of *brucine* are similar to, but less violent than those of *strychnine*. According to Magendie, the proportion in energy is as twelve to one; while Andral estimates, from his own experience, that it requires six grains of brucine to produce the effects of one of strychnine. Four grains of brucine were required to kill a rabbit, and a middle-sized dog had strong tetanic attacks from the same dose, but did not die.*

Tests. *Nux vomica* in powder has a dirty green-gray color and intensely bitter taste, and an odor like powder of licorice. It inflames on burning charcoal, and if nitric acid be added to it, takes an orange-red color, which is destroyed by the addition of protochloride of tin. This red color only occurs *when brucine is present*, combined with strychnine. For the same reason, the infusion of *nux vomica* becomes orange red by nitric acid. It is precipitated grayish white with tincture of galls.

The following directions are given by Simon, for procuring the strychnine from *nux vomica*: Separate, if possible, all foreign matters, boil the substance repeatedly in alcohol at 60 or 70 per cent., filter, concentrate, and boil the alcohol extract with calcined magnesia and water. This causes a precipitation of the strychnine, which may be afterwards separated from further extraneous matters by alcohol.†

Tests of strychnine. (a.) Pass a current of chlorine through water, holding finely powdered strychnine in solution, a white flocculent matter forms on the surface and spreads through the liquid. (Pelletier.)

(b.) Sulphocyanate of potash causes a turbidness, soon followed by a white precipitate. On brucine, it induces none of these effects. (Simon, Notus, O. Henry.)

(c.) Strong sulphuric acid produces no change of color, but

* Magendie's Formulary, p. 17.

† British and Foreign Medical Review, vol. xvi. p. 79.

if a little peroxide of lead be added, a fine blue color appears, which readily passes to violet, then gradually to red, and finally, after a few hours, becomes yellow. (Marchand.) This is considered a very characteristic test.

(d.) If to the sulphuric acid and strychnine chromate of potash in solution in very minute quantity be added, the mixture will take a crimson, passing to a deep blood-red color. (Taylor.)*

[The possibility of detecting strychnia when mixed with morphia, or its salts, in organic fluids, has been questioned, and the decomposition, or masking of strychnia by morphia, has been supposed to account for the failure, in some instances, to detect it. A series of experiments designed to test this question, were instituted by the writer, in which the proportion of morphia varied from one half to five times the amount of the strychnia, and in every instance the strychnia responded satisfactorily to the tests. The same proportions of the alkaloids were thoroughly incorporated with large proportions of articles of human diet, vegetable and animal, solid and liquid, then recovered and subjected to the tests with the same results. More extended experiments of the same kind made by Dr. R. P. Thomas, of Philadelphia, resulted invariably in satisfactory responses to the tests for strychnia.†

It is best to dissolve the strychnine in a drop or two of cold-concentrated sulphuric acid; no change of color takes place, but on the addition of a minute fragment of bichromate of potash, the succession of colors occurs; a similar succession of colors is caused by the addition of a particle of ferro-cyanide of potassium, of peroxide of lead, or of peroxide of manganese.—S. St. J.]

Tests of brucine. Besides the blood-red color induced by nitric acid, and which becomes yellow on the application of heat, I may add the following: Protohydrochlorate of tin, in

* Journal de Pharmacie, vol. xiv. pp. 159, 194; American Journal of Pharmacy, vol. x. p. 160; British Annals of Medicine, vol. i. p. 190; British and Foreign Medical Review, *ut antea*; Chemist, vol. v. p. 112; Taylor on Poisons, p. 690. For Stas' process, see Taylor, p. 692.

† American Journal of Medical Sciences, No. lxxxvi. p. 340.

solution, causes a beautiful violet-colored precipitate. Strong sulphuric acid causes a deep pink color.*

Orfila and Barruel ascertained the presence of this poison in the dead body. They advise that the contents of the stomach be boiled in water acidulated with sulphuric acid. (This if it be *nux vomica*, will become yellowish.) The filtered liquid is then to be neutralized with carbonate of lime, and evaporated to dryness. The dry mass is then acted on with successive portions of alcohol, and evaporated to the consistence of a thin syrup. Ammonia precipitates this; it becomes deep orange red with nitric acid, and will deposit, if left standing, in a day or two, crystals of strychnine.†

It is proper now to arrange, under the head of *Strychnos nux vomica*, the substance which in previous editions I considered under the name of *Brucea antidysenterica*. (Mill.)

Some years since, (about 1807 probably, but the precise time I cannot ascertain,) a patient under the care of Dr. Rambach, of Hamburg, experienced poisonous effects from the use of a decoction, as it was supposed, of angustura bark, and death also resulted from it in Hungary and Berne. This led to an examination, and it was ascertained that two species are known in commerce—the genuine, called West India, and the other spurious, (then and until lately,) supposed to be East Indian, and the bark of the above *Brucea antidysenterica*. Several experiments on animals confirmed the poisonous nature of the latter. The Austrian government was so impressed with the danger to be apprehended, that it ordered all the angustura bark in the empire, genuine and spurious, to be burned, and interdicted its further importation. Its sale was also prohibited in Denmark; and in Russia and Wirtemberg, the characters distinguishing each were published by authority.‡ Some of these may be briefly enumerated:—

* Magendie's Formulary, p. 17. Though discovered in 1818, strychnine was scarcely known to the public as an agent of murder until 1856, when the cases of Palmer and Dove gave it a fearful notoriety. A valuable Report on Strychnia, by Dr. Steiner, was published at Philadelphia, in 1856. See also Brit. American Journal, July, 1851; Med. Times and Gazette October, 1858.

† Christison, p. 752; Lancet, vol. viii. p. 56.

‡ Edinburgh Medical and Surgical Journal, vol. xiii. p. 211.

. The taste of the genuine is aromatic bitter, that of the spurious highly and disgustingly bitter. The concentrated infusion of the first is clear and reddish brown, and when diluted becomes yellow. If an alkali be added, it is changed to a dark red, and a solution of persulphate of permuriate of iron imparts to it a high red color, and, after some time, throws down a rose-colored precipitate. The infusion of the last is not so clear, of a dirty-brown color, and when diluted does not become yellow. On the addition of an alkali, it becomes greenish, and a solution of sulphate of iron gives it a dark-green color, and throws down a copious satin-black precipitate.*

Animals were readily destroyed by this substance, and the symptoms were violent convulsions, resembling tetanus, and which occur in paroxysms. The animal expires in one of these. On dissection, no inflammation is found. Professor Emmert, of Tubingen, communicated the following case to Orfila: "A child died after having taken by mistake a decoction of this bark; he preserved the use of his intellectual faculties, and earnestly begged that he might not be touched, for he experienced terrible cramps after each time that he was handled. He had a copious perspiration, but did not vomit."†

On an analysis, by Pelletier and Caventou, an alkaloid was discovered of poisonous properties, and to it the name of *Bruceine* was given.

But the first doubt relative to the botanical history of this substance, that I have met with, occurs in Burnett, (Medical Botany,) who asserts that the false angustura is brought from South America, and therefore cannot be a *brucea*. He suggests that it is probably a species of *strychnos*. Again, it was denied by some experimenters that the products in question could be obtained from the bark of the genuine *brucea*. Dr. O'Shaughnessy may be considered, I presume, as having settled the question. In a communication, dated at Calcutta, in January, 1837, he states that a crystalline substance was brought

* For a further list of its distinguishing characters, see Orfila's Toxicology, vol. ii. p. 280; Edinburgh Medical and Surgical Journal, vol. xiii p. 210; Philadelphia Journal of Pharmacy, vol. ii. p. 158; American Journal of Pharmacy, vol. xii. p. 241.

† Emmert, in London Medical Repository, vol. vi. p. 89.

to him, which he ascertained to have been prepared from the bark of the *Strychnos nux vomica*—the only poisonous strychnos abundant in the Bengal jungles, with which the natives are familiar—that he analyzed both the bark and the crystals, and found them identical in their physical and chemical composition, (all yielding brucine and traces of strychnine,) and in their physiological effects, with the false angustura.*

Strychnos ignatii, L., or *Ignatia amara*, (Bean of St. Ignatius.) Its operation is similar to the *nux vomica*. Dr. Hopf relates of a man who was attacked with tetanus of several hours duration, after taking the powder of half a bean in brandy.† The native Indian practitioners are said to use it in cholera, and too large doses frequently cause vertigo and convulsions.‡

Strychnos tieute, Leschen. From this plant is obtained the *Upas tieuse* of Java.§ Numerous experiments have been performed with it on animals. It induces tetanus, asphyxia, and death, with great rapidity; and on dissection, Dr. Horsfield found the brain highly inflamed. Criminals in Java are said to be wounded by arrows poisoned with it, and death follows in a few minutes. Pelletier and Caventou obtained strychnine from this species also, combined with various coloring matters.

As to the relative properties of brucine and strychnine in the substance just considered, we are informed by Magendie that the *tieute* contains strychnine perfectly pure; Ignatius' bean, strychnine, with a very small proportion of brucine; and *nux vomica*, both these alkaloids.

Upas antiar is the juice of a large tree in Java, denominated by Leschenault *Antiaris toxicaria*. The ancient opinion concerning the deadly influence of the vapor of the *bohon upas* is now generally abandoned; but it is evident, from the nature of these two indigenous substances, that there was much founda-

* American Journal of Pharmacy, vol. x. p. 144, from Journal of Calcutta Medical and Physical Society for January, 1837; British and Foreign Medical Review, vol. xvi. p. 358.

† Christison, p. 759.

‡ Transactions of Medical and Physical Society of Calcutta, vol. iii. p. 432.

§ *Upas* is probably a common adjunct in the Javanese language to all poisonous plants.

tion for the accounts given of the virulence of the native poisons. In small doses it acts as an irritant, but in large ones causes convulsions and coma.

It operates, however, more slowly than the *tiente*, and, according to Mr. Brodie, death is caused by rendering the heart insensible to the stimulus of the blood, and stopping the circulation. The heart, after death, is found to have lost its irritability.

The French chemists could detect no strychnine in it, but found a bitter substance, soluble in water and alcohol, and concentrating all the noxious qualities of the poison. In very small quantities it proved rapidly fatal. Probably this is the *antiarin*, which is announced to have been obtained from it by Mulder.*

Ticunas, according to De la Condamine, is an extract obtained from various plants by the Indians of South America. The experiments of Fontana with it indicate that it produces death in animals, either externally applied or internally given. The ordinary symptoms are convulsions, faintings, great debility, and loss of feeling.†

Woorara is a poison with which the Indians of Guiana arm

* The following are authorities deserving of consultation on the *tiente* and *antiar*: Quarterly Review, vol. vi. p. 514, American edition. Annals of Philosophy, vol. ix. pp. 202 and 265, containing Dr. Horsfield's essays on upas, or the poison-tree of Java, extracted from Batavian Transactions. Horsfield writes those poisons thus—*antshar* and *tshittik*. Orfila, vol. ii. pp. 260, 287; Eclectic Repertory, vol. ii. p. 281; Brodie's experiments, from Philosophical Transactions. Hosack's Medical and Philosophical Register, vol. i. p. 171, containing Delille's dissertation on the upas *tiente*. Leschenault's account of the upas *antiar*, published in Hooker's Companion to the Botanical Magazine, vol. i. p. 371. Annals of Philosophy, vol. iv. p. 259. See also Medical Commentaries, vol. xv. p. 36; Pelletier and Caventou's paper in full, in Repertory of Patent Inventions, second series, vol. xlv. p. 185; Edinburgh Med. and Surgical Journal, vol. xxiii. p. 224; Albers, Nees, and Emmert's experiments on *tiente*, American Journal of Medical Sciences, vol. vii. p. 223; Penny Magazine, vol. ii. p. 322; Burnett's Outlines of Botany, p. 552; Thomson's British Annual of Science for 1839, p. 353; Lindley's Flora Medica, p. 301; Andral's experiments on the *antiar*, in Orfila, Leçons, third edition, vol. iii. p. 459.

† See the experiments of Fontana, in Philosophical Transactions, vol. lxx. p. 163; also, Dr. Brocklesby's, *ibid.*, vol. xlv. p. 408; and Herissant's, *ibid.*, vol. xlvii. p. 75.

the points of their arrows. It does not appear to differ essentially from the ticunas. Mr. Brodie has performed several experiments with it, and he imagines it to produce death by destroying the functions of the brain.* [Kœllicker found its effects the converse of those of strychnia, paralyzing the heart and voluntary muscles.] According to Mr. Schomburgh, the woorara is obtained from an undescribed species of strychnos, which he styles *S. toxifera*, and he adds as worthy of notice, that Dr. Van Martius found the Indians of the Amazon to prepare a similar poison from a nearly related species of the same genus.†

Curare. The war poison of the Indians on the banks of the Orinoco, in South America. Some interesting details concerning its preparation are contained in the note extracted from one of the latest volumes of Humboldt's Personal Narrative.‡

* Eclectic Repertory, vol. ii. p. 289; Dr. Hancock on the Woorara. (Brande's Journal, N. S., vol. vi. p. 50.)

† London and Edinburgh Philosophical Magazine, vol. x. p. 72. See also Dr. Hancock, in London Medical Gazette, vol. xx. pp. 196, 281; Mr. Waterton's experiments, in Lancet, N. S., vol. xxiv. p. 285; and Medico-Chirurg. Review, vol. xxxv. p. 185; Waterton's Wanderings in South America, 4to., 1825, pp. 20, 50, 81.

An interesting abstract of what is known concerning this poison will be found in the Pharmaceutical Transactions, vol. iii. p. 75.

The poison employed by the natives near Caraccas, in South America, is probably analogous, as M. Predoni detected strychnine in it to the amount of one-sixth to the whole mass. It destroyed life in cats in eleven minutes when inserted under the skin, and the symptom most remarkable was an *uninterrupted* fit of tetanus, during the last seven minutes, until death. The plant producing it is unknown. (Chemist, vol. v. p. 156, from Comptes Rendus, January, 1844.) As to the poisoned weapons of the Peruvian Indians, see Tschudi's Travels, p. 285. Poisons of the Assamese, see London Literary Gazette, 1847, p. 394.

‡ Esmeralda is the most celebrated spot on the Orinoco for the fabrication of this poison. The Indians collect the liana (bejuco) for the preparation of this, (the curare,) and it bears the same name as in the forest of Javita. It is the *Bejuco de mavacure*, which is gathered in abundance on the east of the Mission, on the left bank of the Orinoco, and in other places. "The juice of the liana, when it has been recently gathered, is not regarded as poisonous; perhaps it acts in a sensible manner only when it is strongly concentrated. It is the bark and part of the alburnum which contain the terrible poison. Branches of the *mavacure*, four or five lines in diameter, are scraped with a knife, and the bark that comes off is bruised and reduced into very thin filaments, on the stone employed for grinding cassava. The venomous juice

[Bernard's experiments show that curare, like serpent poison, is rapidly destructive when introduced into a wound, but almost inert when taken into the stomach. Its active principle

being yellow, the whole fibrous mass takes this color. It is thrown into a funnel made of the leaf of a plantain-tree, nine inches high, with an opening four inches wide. A cold infusion is first prepared by pouring water on the fibrous matter, which is the ground bark of the mavaure—a yellowish water filters during several hours, drop by drop, through the leafy funnel. This filtered water is the venomous liquor, but it acquires strength only when it is concentrated by evaporation like molasses in a large earthen pot. The Indians from time to time invited us to taste the liquid. Its taste, more or less bitter, decides when the concentration by fire has been carried sufficiently far. There is no danger in this, the curare being deleterious only when it comes into immediate contact with the blood. The vapors, therefore, that are disengaged from the pans are not hurtful, notwithstanding what has been asserted on this point by the missionaries of the Orinoco. Fontana, in his fine experiments with the poison of the *ticunas* of the River Amazon, long ago proved that the vapors arising from this poison, when thrown on burning charcoal, may be inhaled without apprehension, and that it is false, as M. de la Condamine has announced, that Indian women, when condemned to death, have been killed by the vapors of the poison of the *ticunas*.

"The juice is thickened with a glutinous substance, to cause it to stick to the darts, which it renders mortal; but taken internally, the Indians consider the curare to be an excellent stomachic. Scarcely a fowl is eaten," adds our author, "on the banks of the Orinoco, which has not been killed by a poisoned arrow. The missionaries pretend that the flesh of animals is never so good as when these means are employed. Father Zea, who accompanied us, though ill of a tertian fever, caused every morning the live fowl allotted for our repast to be brought to his hammock, together with an arrow. Notwithstanding his habitual state of weakness, he would not confide this operation, to which he attached great importance, to any other person. Large birds, when wounded in the thigh, perish in two or three minutes; but it is often ten or twelve before a pig or pecari expires." M. Humboldt does not seem to be acquainted with any certain antidote, if such exists, to this fatal poison. Sugar, garlic, the muriate of soda, etc., are mentioned doubtfully. (Tilloch's Philosophical Magazine, vol. lviii. p. 233. See also Orfila, vol. ii. p. 479.)

There is a curious paper on the plants employed by the ancient inhabitants of Europe for poisoning their arrows, by Coquebert, in Philosophical Magazine, vol. xviii. p. 163. He supposes that the juice of the various species of hellebore was used.

Dr. Christison remarks that the best account of the above poison is that by Emmert, published in 1818. It does not produce convulsions or spasms of the muscles, but sudden paralysis. In this way, death is probably caused by suspending the respiration. According to Emmert, the spine only is acted upon, and not the brain. (Page 761.)

is *curarina*, soluble in water and alcohol, possessing the chemical properties of strychnine responding to the tests of that alkaloid.]*

Laurus camphora, L. Camphor, when introduced into the stomach of dogs, produced general convulsions, loss of hearing, foaming at the mouth, and difficult breathing. Vomiting ensued, and they recovered. But when the œsophagus was tied, the consequence was death, and the stomach presented an inflammatory appearance, and in one case ulceration.

Several cases of its effects on man are stated by Dr. Christison. One was of Mr. Alexander on himself. He swallowed in one dose two scruples. In the course of twenty minutes he became languid, and this soon ended in giddiness. At length he lost all consciousness, and strong convulsions, with maniacal phrensy, ensued. He was relieved by an emetic. In Dr. Edwards' patient, as detailed by Orfila, the symptoms were excited by an injection containing a drachm of camphor. It induced staggering and great weakness, with mobility of mind.

Another instance is given by Professor Wendt, of Breslau: An intemperate man took four ounces of camphorated spirits, prescribed for him as an embrocation. Soon after he was seized with fever, burning heat of the skin, anxiety, pain in the stomach, giddiness, dimness of sight, and some delirium. Almond oil and vinegar restored him to health, without any vomiting. A difficulty in passing urine continued for some time.†

Dr. Eickhorn, of New Orleans, relates the effects produced on him, from taking about 120 grains, as resembling the intoxication of champagne. Copious perspiration and weakness ensued.‡

Cocculus indicus. The fruit of the *Menispermum cocculus*,

* Leçons sur les effets des substances toxiques. Paris, 1857, p. 239.

† Christison, p. 763. See also cases by Mr. Hallet, in *Lancet*, September 24, 1842; and by Mr. Clarke, in *ibid.*, November 19, 1842. In the last there was occasional suppression of urine for three months.

‡ *American Journal Medical Sciences*, vol. xi. p. 248. A fatal case, in which an infant eighteen months old having taken about thirty grains, died in seven hours, is given in the *Medical Gazette*, vol. xlvii. p. 219.

(*Anamirta cocculus* of Wight and Arnott.) A native of Malabar and Ceylon. It is used in India for the purpose of intoxicating, and thus killing, fish, and this is done by throwing the berries on the surface of the water. Goupil, a physician of Nemours, ascertained that it destroyed not only fish, but also carnivorous quadrupeds; and Orfila has proved the same on dogs. It acts, he observes, on the brain, and produces convulsions.*

Dr. T. D. Mitchell reports a case where a female took a drink from a bottle containing alcohol, in which the cocculus had been infused for the purpose of destroying vermin. She was comatose, foaming at the mouth, and now and then convulsed. A tobacco cataplasm excited vomiting and purging, and she was relieved.†

Boullay discovered in this substance a peculiar alkaloid, termed *picrotoxine*. It is highly poisonous. Ten grains of it killed a dog in the second paroxysm of tetanus.‡

Coriaria myrtifolia, L. (Myrtle-leaved sumach.) Sauvages states that a laboring man and a child died in horrible convulsions, within half an hour after eating some of the berries of this plant.§

In July, 1828, four little girls, in France, ate some of the berries by mistake. They were all soon attacked with the signs of intoxication; the countenance was livid; and convulsions and loss of speech succeeded. The pupils became dilated, and comatose symptoms supervened. All, however, recovered after vomiting was induced, except the youngest, who sunk under the effects in sixteen hours. On dissection, the membranes of the brain were found much injected, the heart healthy, the lungs gorged, the œsophagus inflamed at its cardiac portion; and there were some red patches in the stomach

* Orfila's Toxicology, vol. ii. p. 305. Two fatal cases are recorded in Traill's Outlines, 146; and Cantstatt, Jarhsbericht, 1844, p. 298.

† Western Medical Gazette, vol. i. p. 20.

‡ Annals of Philosophy, vol. ii. p. 468, vol. xiii. p. 70; Brewster's Edinburgh Journal of Science, vol. v. p. 184.

§ The seeds of the *Coriaria sarmentosa* of Forster (wine-berry shrub of New Zealand) are poisonous, and produce convulsions and delirium. (G. Bennett, in London Medical Gazette, vol. viii. p. 752.)

and intestines. The membranes of the spinal cord were injected.*

In his experiments on animals with this substance, Professor Mayer, of Bonn, found that it excited violent fits of tetanus, succeeded by apoplectic coma. A drachm of the extract of the juice was sufficient to kill cats and dogs. On dissection, the brain is seen gorged with blood, the blood fluid, and the inner membrane of the stomach yellowish and shriveled.†

As to the TREATMENT proper in poisons of this class, although the operation of the more powerful is extremely rapid, yet emetics or the stomach-pump are no less necessary. In the case of *nux vomica* this is particularly required, as its powder adheres with great obstinacy to the inside of the stomach. Artificial respiration and tracheotomy are advised by Magendie and Orfila in imminent cases. The latter also has found some benefit, in his experiments on animals, from giving diluted ether or spirits of turpentine. In case the poison has been applied to wounds, the cautery is proper.

Dr. Donne, of Paris, has announced that iodine, bromine, and chlorine are antidotes to strychnine, if they be given instantly. In numerous experiments on animals, he found the compounds previously prepared to be innocuous. It is, however, unfortunate that a delay of ten minutes destroys their power; and again, the salts of strychnine are more common than the pure alkaloid, and on these the antidotes have no effect.‡

Tannin has been employed with success. In a case related by Dr. Ludicke, a patient took half a grain of nitrate of strychnine in the course of six hours. Tetanic symptoms, with difficulty of breathing and the other characteristic symp-

* Dr. Roûx, of Montaubon. London Medical and Physical Journal, vol. lxi. p. 292; Burnett's Outlines of Botany, vol. iv. p. 887.

† Christison, p. 767. Rabbits are not affected by this poison.

‡ Brande's Journal, N. S., vol. vi. p. 431; Annales d'Hygiène, vol. ii. p. 202. The fruit of the plant *Fuillea cordifolia* has been announced by Drapiez as an antidote to vegetable poisons. He poisoned dogs with the *Rhus toxicodendron*, hemlock, and *nux vomica*, and recovered them with this fruit. (Annales, vol. xv. p. 389.) This, however, is not original with M. Drapiez, as Mosely mentions the same plant as an antidote. (Mosely on Tropical Diseases, p. 37.)

toms, soon followed. Ice was applied to the head, and half a grain of tannic acid was given every half hour, until twelve grains had been taken. This was then followed by a decoction of oak bark with sulph. ether. The patient recovered. Of course, decoction of oak bark or of galls will, in such cases, be of service, when tannin is not obtainable.* Kermes mineral has been recently advised, under the idea that it forms an insoluble sulphuret.†

Poisonous mushrooms. The number and varieties of these are so great that it will unnecessarily enlarge our pages to copy the botanical description of each. I will, therefore, only state a few characters which should lead us to doubt concerning their qualities, and for further particulars refer to systematic writers on this subject.

The following indications should excite a suspicion of mushrooms: A marshy situation in the shade; the substance soft, porous, and moist; an ugly appearance, and the surface more or less dirty; a glairy coat covering the surface; a virulent smell; a bright color, or a combination of different colors. We should also regard as dangerous all which have bulbous or soft stems, or have fragments of skin glued to their surface.‡

The symptoms which generally arise from eating poisonous mushrooms are thus given in a report to the Society of Medicine of Bordeaux, which is quoted by Orfila with high approbation: "Pains of the stomach, gripes, nausea, evacuations upward and downward, are the first symptoms with which the patients are attacked. Shortly after, heat of the bowels and faintings; the pains become more continued and violent; cramps, convulsions, sometimes general, sometimes partial and unquenchable thirst succeed; the pulse is small, hard, tight, and very frequent. When the symptoms, after having lasted a certain time, do not diminish in consequence of the relief afforded, vertigo, a stupid delirium, and drowsiness affect some subjects, and are only interrupted by the pains and convul-

* British and Foreign Medical Review, vol. xiv. p. 229.

† British and Foreign Medico-Chirurgical Review, vol. vi. p. 282.

‡ Orfila's Toxicology, vol. ii. p. 335.

sions. In others there is no drowsiness; the pain and convulsions exhaust the strength; faintings and cold sweats come on, and death puts a period to this series of sufferings, after having been foreseen and announced by the patient himself, who has not lost his senses for a single moment.”*

Poisonous mushrooms do not manifest their action generally until six or eight hours after they are eaten, and twelve or even sixteen sometimes elapse.

The appearances on dissection are as follows: “Violet-colored spots over the integuments, very extensive and numerous; the abdomen extremely bulky; the conjunctiva as it were injected; the pupil contracted; the stomach and intestines inflamed, and scattered over with gangrenous spots—sphacelus is present in some portions of this viscus, and the stomach and intestines are contracted, so much so, indeed, that in these latter the thickened membranes have obliterated the canal. The œsophagus in one subject was inflamed and gangrenous; and in another there was an intus-susceptio of the ileum from above downward, for the space of three inches. One individual alone had the intestines distended with excrementitious matter. In none have any remains of the mushroom been found; they had been either completely digested or evacuated. The lungs were inflamed and distended with black blood; the same congestion had taken place in almost all the veins of the abdominal viscera, in the liver, spleen, and mesentery. Inflammatory and gangrenous spots occur on the membranes of the brain, in its ventricles, on the pleura, lungs, diaphragm, mesentery, bladder, uterus, and even on the foetus of a pregnant woman. The blood in this subject was extremely fluid; in other persons it was almost coagulated. Extreme flexibility of the limbs was not a constant appearance.”†

* Orfila's Toxicology, vol. ii. p. 334.

† Cases of poisoning, by mushrooms, may be found in Orfila's Toxicology, vol. ii. pp. 313 to 333; Foderé, vol. iv. p. 62; Transactions Coll. Physicians of London, vol. ii. p. 216. Case by Dr. Heberden. London Medical and Physical Journal, vol. xii. p. 385. Case by Dr. Bardsley, *ibid.*, vol. iii. p. 41. Case by Mr. Brande, from the *Agaricus glutinosus*, *ibid.*, vol. xx. p. 457. Case by Mr. Parrot, Christison, pp. 768 to 779. Dr. Drake, note to De Salle's Tables, p. 68. Percival's Essays, vol. ii. p. 187. *Agaricus clypeatus*. Dr.

Braconnot and Letellier have analyzed poisonous mushrooms. The latter discovered in one of them a principle, which he called *amantin*, and which appears to be highly deleterious.*

Treatment. The stomach-pump, emetics, cathartics, and particularly enemas, have been found most beneficial. Stimulants

Clendenning's Lecture on the Fungi, in London Medical and Surgical Journal, vol. vi. p. 168. Lancet, N. S., vol. iv. p. 93, vol. v. p. 758. Journal de Pharmacie, vol. xxiii. p. 369: Letellier, Considerations sur les champignons veneneux. Dr. Peddie, in Edinburgh Medical and Surgical Journal, vol. xlix. p. 192. London Medical Gazette, vol. xxv. p. 111.

* Vauquelin's experiments on mushrooms may be found in the Philosophical Magazine, vol. lxiii. p. 292. It would seem that mushrooms of the same species are wholesome or poisonous, according to their locality, country, or season. The peasantry in Russia, and a portion of Germany, live on them during a great part of the year. Old fungi of every description are generally poisonous, and a principle analogous to prussic acid has been found in them. (London Med. Gazette, vol. xviii. p. 177.) Dr. Lefevre, of St. Petersburg, in his observations on the edible mushrooms of Russia (ibid., vol. xxiii. p. 412), seems to question the above statement, and intimates that in England and other countries the distinction between edible and poisonous ones has not been sufficiently investigated in practice. He, however, allows that the Russians eat many which are generally deemed poisonous.

M. Gérard has recently exhibited, before a committee of the Paris Council of Health, the complete innocuousness of the most poisonous species of mushroom, after being subjected to a very simple mode of preparation. The experiment was exhibited in his own person, after both he and all the members of his family had made similar trials with the like result. Two of the most poisonous forms were chosen: the *amanita muscaria* and *venenosa*, of Peirson; and the trial was pronounced quite satisfactory. The preparation, principally consisting in suitable maceration, has indeed been long practiced to some extent by the country people. The researches of Letellier have also shown that the principle which he calls *amanitine* is very deliquescent, and is remarkably and almost exclusively soluble in water. Alcohol only takes it up by reason of the small quantity of water which it contains; and when *amanitine* renders sulphuric ether yellow, this is owing to imperfect rectification. M. Gérard directs that to every five hundred grammes of mushrooms cut up into a medium size, a litre of water, slightly acidulated by two or three spoonfuls of vinegar (or, if nothing else is at hand, gray salt), should be added. If water alone can be obtained, this must be renewed once or twice. In this fluid the fungi are to be macerated for two entire hours, after which they are to be washed in abundance of water. Next, they are to be put into cold water and boiled for half an hour, after which they may be taken out, washed, dried, and used as food. (L'Union Médicale, 1851, No. 148.)

are often subsequently needed, and of these ether is particularly advised by Devergie.

Secale cornutum. (Ergot, spurred rye.) There is some diversity of opinion concerning the real nature of this substance. By some it is supposed to be a diseased process from the juices of the plant. Decandolle, on the other hand, states that it is caused by the growth of a parasitic plant, a mushroom of the genus *sclerotium*; while probably the most numerous party assert that it is the work of an insect. General Field, of Vermont, stated that he had observed flies puncturing the glumes of the rye, during its milky state; and imitating this process himself with a needle, found that in four days a little black point appeared, which gradually became a spur.*

Whatever the cause may be, it is certain that this substance, either alone or contaminating rye, has long been deemed a poison. It is thus stated to have given rise to epidemic diseases at various times, in France, Silesia, Prussia, Bohemia, Saxony, and Sweden. Perrault mentions that in traveling through Sologne, in France, he was informed by some physicians and surgeons of that country that the rye there was sometimes so corrupted that those who ate bread made of it were seized with a gangrene, some in one part and some in another; some losing a finger, others a hand or the nose; and that this gangrene was not preceded by any fever, inflamma-

* See on this subject Brande's Journal, vol. ii. pp. 273, 320; vol. iii. p. 429. Dr. Tully, who supports the opinion of Decandolle, in Silliman's Journal, vol. ii. p. 45. Gen. Field, in *ibid.*, vol. ix. p. 359. Christison, p. 783. "Wiggers, a German writer, adopts the opinion of Decandolle, and seems to place it on a firm foundation." (Christison, 3d ed., p. 830.)

Burnett (Outlines of Botany, vol. i. p. 206,) says that the mushroom is not a *Sclerotium*, but *Acinula clavus*, and in this he is followed in the London Pharmacopœia of 1836, on the authority of Fries; but Dr. Lindley (Med. Botany, p. 624,) says that Fries has no such plant in any of his works. The name used for ergot by Dr. Lindley is *Spermoedia clavus*.

Some interesting facts indicating the insect origin of ergot are mentioned by Mr. Muller and Dr. Carson, in American Journal of Pharmacy, vol. x. p. 269; while Mr. Quekett, in an elaborate paper, (London Medical Gazette, vol. xxiii. p. 606,) advocates the idea of ergot "being a mass composed of the constituents of the diseased grain mixed with fungic matters, and occupying the place of the healthy ovary." See also Lancet, N. S., vol. xxiv. pp. 465, 542; Dunglison's New Remedies, p. 339.

tion, or considerable pain, but that the parts fell off of themselves: the early symptoms were numbness, cold and livid skin, pain and swelling.*

Tissot, in a paper in the Philosophical Transactions, presents a very copious account of the disease in question, and divides it into two forms, the spasmodic and gangrenous. He observes that the first accurate account of it was published in 1596. The spasmodic disease prevailed, according to Hoffman, in 1648, 1649, and 1675, in Voigtland; in 1702 in Friburgh; in 1760 in Saxony and Lusatia; and in 1722 in Silesia. It was frequently attended with epilepsy. The gangrenous form was known in France as early as 1630; and in 1650, 1670, and 1674 it raged in Aquitaine and Sologne. In 1709 it appeared in Switzerland. The symptoms were similar to those already noticed. It attacked persons of both sexes and all ages, and in some instances only the lower extremities became gangrenous, while in others both upper and lower were affected.†

Mr. Srine has described its effects as occurring in 1736, in Bohemia. It commenced with an uneasy, stinging sensation about the feet. To this severe cardialgia succeeded, and the hands and head were soon after affected. The fingers were strongly contracted, and there was a sensation of burning in the hands and feet. Giddiness, mania, or coma, succeeded, accompanied with opisthotonos, and a foaming at the mouth. These symptoms were followed by a canine appetite. All those who had epileptic symptoms died. The pulse was natural, and the spasms left a stiffness of the limbs. The disease continued two, four, eight, and sometimes even twelve weeks. Out of five hundred persons, three children died.‡ Gangrene

* Philosophical Transactions, vol. xi. p. 758; see also vol. lii. p. 529, where cases are related that occurred at Orleans and Blois.

† Philosophical Transactions, vol. lv. p. 106.

‡ Orfila's Toxicology, vol. ii. p. 349. There is a late account of the disease occurring in a part of France in 1828. (North American Med. and Surg. Journal, vol. vii. p. 192.) Bonjean (*Encyclographie des Sciences Médicales*, January and February, 1845,) relates two cases of children, in which spontaneous gangrene was induced from eating ergoted bread. It finally proved fatal in the oldest, ten years of age, but the youngest (twenty-eight months) survived.

of the extremities has also been observed in animals from the administration of ergot.

By those who are not willing to concede so much power to this substance, the combined influence of famine and poverty is urged as sufficient to explain these endemic diseases. But from the results of experiments made of late years, the probability is in favor of the noxious nature of ergot.*

Dr. Lorinzer, of Berlin, (Lorimer, according to Dr. Christison,) relates some experiments made on the healthy subject. A single dose, two drachms, for example, excited giddiness, headache, pain and spasms in the stomach, nausea and vomiting, colic and purging.†

Instances of the dangerous effects of this substance (independent of its peculiar action on the uterus) are not uncommon.‡

The different attempts at the analysis of ergot have not led to very satisfactory results.§ Dr. Hooker, of New Haven, obtained an oil from it which possesses narcotic properties, but apparently exercises no power on parturient women. He therefore recommends the *infusion*, instead of the ergot in

* See Samuel Cooper, *First Lines*, vol. i. p. 48. Rees' *Cyclopedia*, art. *Ergot's sacer*, contains some valuable remarks in favor of referring these diseases to deficiency of nourishment rather than to diseased grain. It was at one time thought by some that the spotted fever, which ravaged several districts in the United States some years since, had its origin in part or altogether from eating this substance, combined with grain. The facts adduced are very unsatisfactory, and lead to no definite conclusion. Some observations on this subject are contained in the *New England Journal*, vol. v. pp. 133, 156, (an article by Professor Bigelow,) and p. 235.

† *Edinburgh Medical and Surgical Journal*, vol. xxvi. p. 453, from Rust's *Magazine*; see also Dr. Jorg's experiments, in *American Journal Medical Sciences*, vol. xx. p. 176.

‡ Dr. Swett, in *Boston Medical and Surgical Journal*, vol. xi. p. 420. Dr. Hulse, in *North American Archives*, vol. ii. p. 81. *Medico-Chirurgical Review*, vol. xxv. p. 435. *American Medical Intelligencer*, vol. iii. p. 213. Case by Dr. Beckwith.

§ Analysis of Battley, in *London Medical Gazette*, February, 1831; of Wiggins, of Berlin, in *Lancet*, N. S., vol. xi. p. 82; of Dr. McKee, in *American Medical Intelligencer*, vol. iii. p. 162; of Dr. Wright, of Edinburgh, (very elaborate and valuable,) in *Edinburgh Medical and Surgical Journal*, vols. lii. liii. liv. Parolas' *Essay*, *Encyclographie des Sciences Médicales*, June and August, 1844. Le Grip, *ibid.*, August, 1844, and *Chemist*, vol. v. p. 465. Bonjean, *Encyclographie*, vol. ix. p. 613.

substance, for parturient women.* “Wiggers denies the presence of prussic acid and of fecula, and says he found ergot to consist chiefly of a heavy-smelling fixed oil, fungin, albumen, osmazome, waxy matter, and an extractive substance of a strong, peculiar taste and smell, in which, from experiments on animals, he was led to infer that its active properties reside. I have obtained all his chief results, except the most important, for the substance which ought to have been his *ergotin*, was destitute of any marked taste or smell.”†

The researches of late experimenters may, I suppose, be considered as showing that the oil of ergot is innocuous, and that the aqueous extract, in some way or other, contains the *ergotin* or whatever constitutes the deleterious principle. In confirmation, I refer to the authorities given below.

Spurred maize. It appears, from the researches of Roulin, that Indian-corn is very subject to the spur in Colombia, and that in this state it is noxious to man and animals. Individuals lose their hair and teeth from eating it, but are never attacked with gangrene or convulsion. Hogs and mules also lose the hair, and poultry frequently lay their eggs without any shell.‡

Diseased wheat. When the farinaceous part of this plant becomes converted to a black powder, it imparts injurious qualities to the bread. Foderé states that he saw, in 1808, colics and diarrhœas which arose from this cause.

Lolium temulentum, L. (Darnel.) Naturalized in the United States. Bread made from the farina of the seed of this plant and taken to the amount of six drachms, caused distraction of thought, indistinct vision, torpor, debility, and drowsiness, and these were followed by efforts to vomit. Tremors of the limbs, great depression, and difficulty of speech and vomiting succeeded.§ Similar effects were induced in a family, from eating oat-bread mixed with darnel. The tongue exhibited a

* Boston Medical and Surgical Journal, vol. x. p. 298.

† Christison, 3d ed., p. 831.

‡ Christison, p. 788; Edinburgh New Phil. Journal, vol. vii. p. 217.

§ London Medical Repository, vol. xiii. p. 260. This is the result of an experiment by Dr. Cordier, on himself, with six drachms taken early in the morning.

very strong trembling; and Seeger, indeed, remarks that the trembling of the body is one of the most certain signs of poisoning by this plant.* Animals, and particularly dogs, are affected in the same manner as man. Chickens, however, eat the seeds with greediness, and without any bad consequences.†

The *Lathyrus cicera*, L., (Chick-pea,) and *Ervum ervilia*, L., (Bitter vetch,) have each proved noxious in France, from their seeds becoming mixed with wheat or rye, and thus forming part of the food used. The symptoms induced are very similar to those of darnel.‡

Mr. Chevallier, in a memoir on the effects of the lathyrus when used as food, mentions numerous cases where paralysis of the lower extremities, a peculiar affection of the larynx giving rise to asthmatic symptoms, and even death itself, were induced. In 1829, the inhabitants of one of the departments were obliged, in consequence of scarcity, to mix the flour of the chick-pea with that of wheat, and when in equal quantities, the bread made had a black color, a bitter taste, and a moldy smell. All who used it for any length of time became affected with convulsive tremors of the lower extremities, great weakness, and at last a kind of incomplete paralysis. Violent thirst was also present, and many were affected with somnolency.

The testimony is somewhat discordant as to the effects on animals. In many instances, however, the use of it as food proved deleterious to horses, and generally the results were unfavorable, being productive of general weakness and spasmodic affections.§

* Orfila's Toxicology, vol. ii. p. 352. Another case of the noxious effects of Darnel is related in the Edinburgh Medical and Surgical Journal, vol. i. p. 106. It happened at Genoa, during the scarcity occasioned by its blockade, in 1800. See also Christison, p. 732. Burnett's Medical Botany, vol. i. Ruspini, from Journal de Chimie Médicale, February, 1844, in Chemist, vol. v. p. 184.

† Edinburgh Medical and Surgical Journal, vol. i. p. 107. Pfaff has examined darnel to find an alkaloid, without success. He obtained, by distillation, two kinds of oil. (Pharmaceutical Journal, October, 1846.)

‡ Christison, p. 792.

§ Annales d'Hygiène, vol. xxvi. p. 126.

Cytisus laburnum, L. (Laburnum.) The seeds and flowers of this plant are poisonous. Mr. North, of London, relates the case of a girl, four years old, in whom the eating of the flowers caused convulsive twitchings of the muscles of the face, cold skin, short and laborious respiration, very weak pulse, with ineffectual retchings. She was gradually relieved by vomiting and stimulants.* Dr. George Johnston, of Berwick-upon-Tweed, saw three young children, under seven years, extremely ill from eating the seeds. They were relieved by vomiting.†

In two cases communicated by Dr. Traill to Dr. Christison, the effects seem to have been almost purely narcotic. Insensibility occurred quickly, with frothing at the mouth, and a feeble pulse. Both, however, were relieved by emetics.‡

That the bark has equally noxious properties, was shown in a trial at Inverness, in Scotland. A farm servant, on bad terms with the cook, and with a desire to give her something that should cause vomiting and purging, put some of the bark in her broth. In five minutes she was seized with violent vomiting, followed some hours after by purging. It was some time before she partially recovered. These symptoms, however, recurred in a degree daily, and at the end of six weeks she had to give up service. Medical aid was now sought, and this led to a judicial investigation. She had all the symptoms of gastro-intestinal irritation, being greatly reduced in flesh and strength; and only recovered slowly.

The nature of the substance given was satisfactorily ascertained by Dr. Christison, and in a number of experiments with animals, it proved rapidly destructive to them.§

The active principle is thus evidently present in the seeds, flowers, and bark of this plant. It was discovered by Chevallier and Lassaigne, and denominated *cytisine*. This acts both as a violent emetic and purgative. Chevallier took eight grains, which operated most severely, and he had to combat its effects by large doses of acidulated drinks. In small doses,

* London Medical and Physical Journal, vol. lxii. p. 86.

† Loudon's Magazine of Natural History, vol. vi. p. 74.

‡ Christison, 3d edition, p. 842. See also the narrative of eleven boys poisoned by the seeds, related by Mr. Bonney. (Lancet, January 9, 1841.)

§ Edinburgh Medical and Surgical Journal, October, 1843.

cytisine causes vomiting, convulsions, and death, when administered to animals.*

Alcohol. On the effects of this poison, when taken as it ordinarily is by persons in habits of intoxication, it is not necessary for me to enlarge. I have only to refer to the effects of it in a pure state and in large doses, and then by comparing these results with the table published by Mr. Brande, of the quantity of alcohol contained in various kinds of liquors, an idea may be formed of the injury, and indeed danger, to which life is so freely and generally exposed.†

Mr. Brodie injected proof-spirits into the stomach of a rabbit; in five minutes he lay motionless and insensible; the pupils of the eyes were dilated; there were slight convulsive motions of the extremities; the respiration was laborious; and he finally died at the end of an hour and fifteen minutes. In his further experiments, he found the stomach highly inflamed by the injection of this poison, but never observed any preternatural appearances in the brain. The symptoms, however, produced by spirits are very analogous, he observes, to those caused by injuries of the brain.‡

Orfila found proof-spirits to be a violent poison when injected into the cellular tissue, and that it produced the same effects as when introduced into the stomach. In animals killed with it, the villous coat of the stomach was constantly of a cherry-red color. Dr. Christison remarks that he has several times observed the same appearances.§ There is a beautiful plate, (8th), exhibiting the effect of injecting proof-spirits into the stomach of a dog, in Dr. Roupell's *Illustrations of the effects of Poisons*.

In what may be styled poisoning by alcohol, apart from the ordinary effects of intoxication, the comatose state becomes

* Thomson's *Materia Medica*, vol. ii. p. 111; London Medical and Physical Journal, vol. lxii. p. 93; Christison, p. 793.

† See Mr. Brande's Tables, in his *Journal*, vol. v. p. 152.

‡ Eclectic Repertory, vol. ii. p. 269.

§ Christison, p. 800. The experiments of Segalas are to be found in the *Medico-Chirurgical Review*, vol. x. p. 218. The action of alcohol on the blood, both physiologically and pathologically, has been examined by Professor Schultz. (*British and Foreign Med. Review*, vol. xvi. p. 218.)

deeper and deeper, with dilatation of the pupils and inability to swallow. Apoplexy is excited in some cases. "These, however, can scarcely be considered as simple poisoning, but as the result of poisoning developing a tendency to apoplexy." In those instances, where large quantities of spirits are swallowed, as for example, in wagers for prowess in drinking, coma comes on suddenly. The face then is sometimes livid, but more generally ghastly pale; the breathing stertorous; the pupils sometimes much contracted, but more commonly dilated and insensible; and if relief be not speedily obtained, death takes place, sometimes immediately, or at least in a few hours.*

Mr. Bedingfield, whose experience has been quite extensive, supposes that the degree of danger from intoxication may be best estimated by the irritability of the iris. If it, says he, retain its contractile power, the patient will generally recover, however overpowered his senses may be; but if it remain in a state of extreme dilatation when a strong light is directed upon it, a feeble hope of recovery can only be entertained. This paralysis of the iris is generally accompanied with apoplectic stertor, labored and imperfect respiration, and a slow,

* Dr. Chowne relates of a boy, between seven and eight years old, who swallowed half a pint of gin, and in half an hour became insensible. He was not seen by a medical man until five hours afterwards. An emetic, and subsequently the stomach-pump, were used without effect. The breathing was slow and stertorous; pupils contracted; limbs relaxed; and the countenance placid: but the general appearance was that of sinking. In spite of active remedies, which caused a partial improvement, such as a diminution of coma, he gradually sunk, with a constant increase of the mucous rattle, and died in sixty-seven hours after taking the gin. No convulsions or even tendency to them had been present—nor delirium or injection of the conjunctiva. On dissection, but few marks of disease^a could be discovered in any of the cavities. The veins of the head were full, but the quantity of fluid was natural. The trachea and bronchiæ were full of a frothy fluid, but the lungs were not much congested. The stomach was rather paler than usual, and free from discolorations. All the other viscera were healthy. The surface of all the organs of the body, however, presented one remarkable feature, viz., a tendency to dryness. Thus the brain, lungs, heart, and intestines became so dry, immediately on exposure to the air, that they did not communicate the slightest moisture to the fingers. (London Medical Gazette, vol. xxiv. p. 376.)

oppressed pulse. Next to the insensibility of the iris, want of energy in the stomach indicates the greatest danger.*

Dr. Ogston, of Edinburgh, has published a valuable paper on this subject. Having seen a number of extreme cases, many of which ended in death, he is disposed to classify them with reference to the state of the pupil. In six cases out of twenty-six, it was contracted, and the coma was profound. The body generally preserved its natural warmth; the countenance was pale, and the breathing stertorous. The remaining twenty, with dilated pupil, had the pulse either imperceptible or very feeble and slow; the coma was profound as in the former; the extremities often cold; the face generally flushed, and the breathing either laborious or calm, but usually slow. Convulsions were not a common consequence. The most dangerous cases, I need hardly add, were in the last class.†

Appearances on dissection. There is some difficulty in accurately ascertaining these, from the fact that most of the subjects have been in long-continued habits of intoxication; and the results of this, rather than the immediate indications of poisoning, are present. Congestion, and even actual extravasation of blood in the brain, are not unfrequently found in those in whom apoplexy has been superinduced, and this, although the individual may be quite youthful. In a female, who for fourteen days had been very little in her sober senses, and at the end of that period died comatose, Dr. Christison found an enormous extravasation in the ventricles.‡

* Bedingfield, in *Edinburgh Medical and Surgical Journal*, vol. xii. p. 493. There is a paper from the French, well worthy of perusal, on the symptoms of intoxication, in *New England Journal*, vol. viii. p. 389.

† *Phenomena of the more advanced stages of intoxication, with cases and dissections*, by F. Ogston, M. D., *Edinburgh Medical and Surgical Journal*, vol. xl. p. 276. Larrey, in his *Surgical Memoirs*, (p. 6,) says that many French soldiers died in the Russian expedition from drinking the *chenaps* (schnaps,) the brandy of the country. It is obtained from corn; and to this fermented liquor plants of the narcotic class are added. Those who died showed the following symptoms: Loss of muscular motion, vertigo and drowsiness, the eyes half closed, dull, and weeping, and the conjunctiva appearing as though injected. These are to be considered as the *ordinary* effects of intoxication, and not what we understand as poisonous.

‡ Christison, p. 801. He also quotes cases from Bernt. See also Newbigging's Case, *Edinburgh Medical and Surgical Journal*, vol. xxix. p. 412;

Should this morbid appearance be absent, it is still very common to find serum in the ventricles, much beyond the natural quantity, with a congested state of the membranes. The lungs are also dilated with dark fluid blood, and there is more or less of frothy mucus in their substance. The air-passages are red, but the stomach has seldom been seen to bear the marks of irritation which we should expect, and which has been so much insisted upon.* It is hardly necessary to add, that in habitual drinkers, the liver, kidneys, etc., will be more or less diseased.

It has been a curious question whether, in persons dead from alcohol, the presence of that substance can be detected by the smell. We know that during life the breath is strongly tainted with it. Dr. Cooke, on the authority of Sir Anthony Carlisle, mentions an instance where the fluid found in the ventricles of the brain had the smell and taste of gin. Dr. Christison quotes Dr. Wolff for a similar case where the fluid in the ventricles had the smell of brandy, although the con-

Ogston's cases, *ibid.*, vol. xl. p. 290; Andral's Dissections, *Medico-Chirurgical Review*, vol. xxvii. p. 99.

* Christison particularly remarks this. A case is also given in the *Lancet*, vol. x. p. 571, where a chimney-sweep drank eighteen glasses of rum in quick succession, (upwards of a quart.) He died in six hours. On dissection, the brain presented bloody spots; on being sliced, its sinuses were loaded with blood; there was but little serum in the ventricles, and the *stomach was natural*.

Dr. Hodgkin, however, injected an ounce of strong spirits of wine into the stomach of a dog. Death ensued in forty-two minutes. "The mucous membrane of the stomach offered strongly marked and irregular rugæ, in the intervals between which the mucous membrane had a corrugated appearance. It was universally of a reddish-brown color." Report of British Association, 1835, p. 233.)

Dr. Nicol, of Inverness, also relates a case where death ensued, probably in a very few hours, and the mucous membrane of the stomach, along with that half way up the œsophagus, was highly injected, being of a deep crimson. The intestines presented a like appearance, but less intense. The vessels of the brain were highly congested. (*London and Edinburgh Monthly Journal Medical Science*, vol. iii. p. 499.

"Dilute alcoholic fluids produce no chemical change in the coats of the stomach, but in the case of persons of temperate habits chemical reactions are to be apprehended from the immoderate use of a fluid containing forty per cent. of brandy." (Mitscherlich, *Medico-Chirurgical Review*, vol. xlv. p. 181.)

tents of the stomach had not. Dr. Ogston examined the body of a woman who drowned herself in a state of intoxication. "We discovered nearly four ounces of fluid in the ventricles, having all the physical qualities of alcohol, as proved by the united testimony of two other medical men who saw the body opened, and examined the fluid. The stomach also smelt of this fluid."

On the other hand, many cases occur of persons dying in a fit of intoxication, in which this is not perceived, and Dr. Christison says that he has "several times remarked that the venous blood and brain of a fresh subject had a smell which a prepossessed person might have confounded with that of alcohol, although no spirituous liquor had been taken before death."*

Dr. Percy has recently investigated this subject experimentally, and I find the following stated as the result: He obtained alcohol from the brains of dogs poisoned by it; but none of his experiments have enabled him to determine whether the fluid of the ventricles, under such circumstances, contains any alcohol. "It would rather appear that there was some peculiar affinity between the substance of the brain and spirit, and especially as, after analyzing a much larger quantity of blood than can possibly exist in the cranium, he could generally obtain much more alcohol from the brain than from this quantity of blood. In his experiments, Dr. Percy also detected alcohol in the *blood, urine, bile, and liver.*"

The alcohol is separated from the solid or fluid supposed to

* See on this point the experiments of Dr. Pommer, London Medical Gazette, vol. xvi. p. 814, and the dissection of Mr. Watson, in his work on Homicide, pp. 169 to 177.

Dr. Bradley (Illinois Medical and Surgical Journal, vol. i. p. 27,) relates a case of a person found moribund along the high-road, and who died in ten minutes after. He had been drinking freely for several days. On dissection, the brain was found extremely turgid; dark fluid blood poured from the sinuses of the brain to the amount of eight or ten ounces; in the *corpora striata* a small amount of sanguineous extravasation was detected, and in the lateral ventricles some serous effusion. Verdict, "death from apoplexy, caused by intemperance."

The effused fluid found in the ventricles yielded strongly the alcoholic odor. This was so apparent that it was readily recognized by every member of the jury.

contain it, by distillation with water, and the former is again separated from the latter by subcarbonate of potash. Although always small in quantity, its nature was positively ascertained by its inflammability and its power of dissolving camphor. It appears, however, that he could not obtain the alcohol, unless death ensued shortly.*

Treatment. From numerous observations, it would seem that carbonate or acetate of ammonia, given internally, is one of the best remedies for counteracting the severe effects of intoxication.† The cold affusion is very useful, unless the temperature of the body be so low as to render it improper. In such cases every effort to maintain or restore the natural warmth must be made. Emetics or the stomach-pump must also be used. As to venesection, unless the present symptoms indicate its necessity, it is not to be recommended. Many, no doubt, have sunk from its rash use.

At the Edinburgh police-office, Dr. Christison informs us, the injection of water into the ears is one of the most effectual stimulants. Mr. Sampson, in a recent case of deep intoxication, where the stomach-pump and other remedies proved ineffectual, and the patient became more and more comatose, preserved life by resorting to tracheotomy.‡

* British and Foreign Medical Review, vol. viii. p. 540; Edinburgh Medical and Surgical Journal, vol. liii. p. 253. In confirmation of this, Dr. Lewis communicates a case that occurred at Edinburgh in 1840, where alcohol was detected in the substance of the brain, treated as above, while no alcoholic odor could be detected in the fluid of the ventricles, nor indeed any other part of the body. (Medical Examiner, N. S., vol. i. p. 239.)

Dr. R. D. Thomson has proposed a minute test, viz., to drop a crystal or two of chromic acid (or bichromate of potash and sulphuric acid) into the distilled liquor, as above. If the smallest quantity of alcohol be present, the green oxide of chrome will be disengaged and the smell of aldehyde is distinctly perceptible. (Monthly Journal Medical Science, December, 1846.) I observe that Mr. Taylor speaks doubtfully concerning this.

† Dr. Dupuy, of Alfort, injected alcohol into the jugular vein of a horse. It caused all the effects of intoxication, staggering, redness of the conjunctiva, etc. Five grains of the carbonate of ammonia, dissolved in water, were then also injected, and the above symptoms immediately ceased. Lancet, N. S., vol. viii. p. 76.)

‡ Medico-Chirurgical Transactions, vol. xx. p. 46. There have been some curious cases noticed, (by Dr. Bird and others,) in which, after persons have apparently recovered from the effects of large doses of alcohol, taken either

Sulphuric ether, introduced into the stomach of animals when the œsophagus was tied, produced vertigo, great weakness, difficult breathing, drowsiness, and death. The mucous membrane of the stomach was highly inflamed, as was also the duodenum; the blood in the heart was black, partly fluid, and partly coagulated.*

"Some years ago," says Dr. T. D. Mitchell, "a practice obtained among the lads of Philadelphia, of inhaling the vapor of sulphuric ether by way of sport. A small quantity placed in a bladder was almost instantly converted into vapor by the application of hot water. By means of a tube and stop-cock, the gas could be easily inhaled. In some instances, the experiment excited mere playfulness and sprightly movement, but in several cases delirium, and even phrenitis, was induced, which ended fatally."†

The reader will observe that these and the cases quoted below occurred previous to the general introduction of the inhalation of the vapor of ether in the practice of midwifery and surgery. I give no information when I say that this has sometimes induced death.

According to the experiments of Amusat and Mitscherlich on

by accident or design, yet at the end of some weeks the health declines, the memory is impaired, and a general unfitness for any active occupation occurs. (*Lancet*, N. S., xxv. p. 166.) In recent cases, great caution is necessary on the part of the practitioner not to mistake the effects of deep intoxication for the symptoms of apoplexy. If bleeding be too early used for the former it will promote absorption. The state of the breath should be attended to, and the symptoms must be carefully compared.

* Orfila's *Toxicology*, vol. ii. p. 342. Dr. Godman has announced a curious result from the inspiration of the vapor of sulphuric ether. It produces all the effects of nitrous oxide. Its exhilarating effects were striking, but in one individual (a female) predisposed to consumption, the muscular action induced left a cough, derangement of mind, and pain. She had several attacks of violent syncope, and remained ill for some time. (*Godman's Western Reporter*, vol. ii. p. 111.)

† Mitchell's *Chemistry*, p. 172. Dr. Miller, of Louisville, relates the case of a female, aged fifteen, of nervous temperament, who breathed sulphuric ether five times in succession. She felt exhausted after it, and the next day had headache, partial blindness, and great debility. She became delirious, and finally had more or less of the symptoms of phrenitis. She died on the twelfth day. No dissection was made. *Western Journal of Medicine and Surgery*, vol. xiii. p. 25; see also *Lancet*, N. S., vol. xix. p. 271.)

animals, the ether evidently penetrates the membranes, and is absorbed by the blood. The arterial blood is found black and limpid, and in very recent cases, the odor of ether is detected. The internal viscera are congested, the heart greatly distended, the lungs deep red, and the vessels of the brain quite injected.*

Nitric ether. A gentleman communicated a case at the London Royal Institution, April, 1830, which had lately happened at a druggist's, from a carboy of nitric ether being placed in a bedroom, and which bursting in the night, the chamber became filled with the vapor. It had no chimney, and the door was shut. The servant who slept in it was dead. It is added that this was the second case that had come to the knowledge of the writer.†

A female in the service of Mr. Thomas, druggist, at Hay, Breconshire, went to bed in perfect health, but did not rise the next morning at her usual hour. On going to call her, the door was found fastened, and on breaking it open, she was seen dead, lying on the right side, with the arms folded across the breast, as in profound sleep, and the features calm.

The body was opened. The coats of the stomach were a little inflamed, and it contained a little fluid. The intestines were turgid and the lungs gorged. The uterus was found impregnated and bearing a three months' male foetus. The dissection proceeded no farther. In the room was a large jar, containing upwards of three gallons of nitric ether, broken and the contents spilt about the room. The apartment being small and the atmosphere strongly impregnated with this vapor, the medical witnesses were of opinion that the effluvia caused her death, and such was the verdict of the coroner's jury.‡

Chloroform. The same observations that I have made rela-

* Amusat, Comptes Rendus, February 22, 1847. Mitscherlich Medico-Chirurgical Review, vol. xliv. p. 181.

† London Medical Gazette, vol. vi. p. 85.

‡ Midland Medical and Surgical Reporter, vol. i. p. 232; Edinburgh Medical and Surgical Journal, vol. xxxv. p. 452. "The woman seems to have died, as in cases of poisoning with carbonic acid, from slow obstruction of the breathing, from gradual asphyxia; and in no other circumstance is it usual to find such extensive and intense congestion of the mucous membranes." (Ibid.)

tive to sulphuric ether are still more applicable to the present substance, and whether the article employed in certain cases be pure or impure, yet the fatal cases are multiplying.* It is manifestly rapidly absorbed by the blood, and has caused death in a few moments when inhaled.

The detection of it must be attempted with the blood, and for this purpose it is advised to place it in a sand bath, pass the resulting vapor through a tube heated in the centre to a red heat, and lined at its extremity with a paste of iodide of potassium and starch, its open end being also covered with paper moistened with the same mixture. If chloroform be present, the paper will be tinged blue.†

It may possibly be most accordant to symptoms, to place alcohol, ether, and chloroform among narcotic poisons; but I have preferred, for the present, to continue the former arrangement. For the same reason I subjoin, in this place, a brief notice of several of the *essential oils*, although possibly belonging to the class of irritants. -

Oil of cedar. (Cupressus thyoides.) I mention this first because it is so frequently employed in this country, without regard to its violent action as an abortive. I have received a communication from Dr. Hough, of St. Lawrence County, N. Y., in which he states that no less than six fatal cases from taking this have occurred in that county during the last three years; while at the last oyer and terminer, a young man was convicted of manslaughter for giving a drachm to a female, in order to produce abortion. Death ensued in forty minutes. Dr. Wait reports four cases in the Boston Med. and Surg. Journal, vol. xl. The symptoms appear to be vomiting, a violent contraction of all the voluntary muscles, great suffering, followed by stertor and rapid sinking.

Oil of tansy. (Tanacetum vulgare, L.) A female, aged twenty-seven, in Boston, took half an ounce. Spasms ensued, and

* Edinburgh Medical and Surgical Journal, vol. lxxiii. p. 252. Dr. Snow has recorded fifty fatal cases. (London Journ. Med., 1852; Med. Times and Gaz., December, 1853.) In one instance thirty drops proved fatal in one minute. (Dr. Warren's Table of Fatal Cases, p. 23.) *Amygline* has proved more dangerous than chloroform. (Med. Times and Gaz., 1857.)

† London Medical Gazette, vol. xlv. p. 310.

although emetics and the stomach-pump were used, she died in two hours. On dissection, a strong odor of tansy was perceived; the blood was dark and thick; the stomach and intestines were healthy.* Dr. Daniel Drake mentions that within the year 1833, two persons (both young women) have died in Cincinnati, from the distilled oil of tansy. One took it by mistake; the other was probably a suicide.†

Oil of wintergreen. (*Gaultheria procumbens*, L.) An individual in New York was supposed to be poisoned by this in 1832. He had been intemperate, but was not otherwise disordered. Death ensued in fourteen hours; and on dissection, marks of inflammation in the stomach were seen. Probably a fluid ounce had been taken.‡

Volatile oil of mustard, of savine, of caraway, and of fennel. Each of these have been found by Mitscherlich to be active poisons, readily absorbed, but producing very little change, except congestion in the intestinal canal. The *volatile oil of turpentine*, and even *copaiba*, is poisonous, but in less degree.§

Empyreumatic oils. Some of these act powerfully on the human system, and two are mentioned by Professor Christison which deserve a brief notice.

One is the empyreumatic oil procured by the destructive distillation of lard. Buchner found that five drops introduced into the throat of a bird proved nearly fatal. The symptoms were excessive exhaustion, slow respiration, and insensibility.

Dippel's oil, or rectified empyreumatic oil of hartshorn. Chaussier relates a case where an individual took a spoonful by mistake, and died immediately. No morbid appearances could be found. Another case is quoted from a French journal, where a female took designedly an ounce and a half. From what could be ascertained, it appears that she vomited, and not finding the action of the poison to her wishes, threw herself into a well and was drowned. The whole body exhaled the peculiar fetid odor of the oil. The palate, tongue, throat,

* Case by Dr. Hildreth, Boston Medical Magazine, vol. iii. p. 213.

† Western Journal of Medical and Physical Sciences, vol. vii. p. 569.

‡ Philadelphia Journal of Pharmacy, vol. vi. p. 289.

§ Chemist, July, 1844; Pharmaceutical Journal, vol. ix. p. 233.

and gullet were white and shriveled. The stomach, outwardly, was of a rose tint, crossed by gorged black veins, which here and there had burst and formed patches of extravasation. The oil and some extravasated blood were found in it. Its villous coat was thick, covered with red points, and corrugated. The intestines had similar, but inferior marks of irritation.*

Oil of tar. A young man, aged eighteen, took two or three draughts of this substance, and soon became insensible; the pulse was scarcely perceptible, and the extremities cold. The stomach-pump and external stimulants were used. Venesection was then tried, and an active enema, but without benefit. The coma continued, and he died in about twelve hours after taking it. On dissection, the mucous membrane of the larynx and trachea was seen highly injected; the lungs gorged with blood, and smelling strongly of the oil. The stomach paler than natural, and in one portion an orange-yellow spot. The brain natural.† Other instances have occurred, where in less quantity, it produced violent vomiting, prostration of strength, and pain.

In connection with these, I may mention the substance lately discovered by Reichenbach, and termed *Kreosote* or *Creosote*. It is derived either from pyroligneous acid or from the tarry matter that distills over along with that acid. When in a concentrated state, it destroys the epidermis, and insects and fish thrown into it immediately die. According to Mignet, it acts by irritating the surfaces to which it is applied. Redness of the mucous membrane will hence be produced, and the poison may be detected by its odor, and by the alimentary matters coagulating albumen. In dogs poisoned by it, mucus was rapidly secreted in large quantities, and produced suffocation.‡

We have, in addition to these, the experiments of Corneliani and Cormack. According to the latter, creosote appears to act on the heart itself, which it seems almost instantaneously to paralyze. There appear also to be many points of resemblance

* Christison, p. 806; Edinburgh Medical and Surgical Journal, vol. xxxiv. p. 214.

† Lancet, N. S., vol. xiii. p. 902.

‡ Edinburgh Medical and Surgical Journal, vol. lxi. p. 248.

between its effects and those of prussic acid. One is, that the odor is diffused through all the tissues, and indeed continues the longest with creosote.*

In June, 1839, an aged female was indisposed, and recommended to take her usual night draught. It would seem that the druggist, in preparing it, mixed the ingredients with two drachms of creosote, instead of two drachms of spirits of camphor. She was soon seized with agonizing pain. Every remedy failed, and she died on the morning of the second day.†

According to Corneliani, almond, olive, and castor oils, and the volatile stimulants, appear to possess some power as antidotes. Vinegar increases its poisonous effects. The remedies advised by Cormack are the same as for prussic acid—chlorine, ammonia, and other stimuli.‡

Fusel oil, obtained during the manufacture of potato spirit, has a very disagreeable smell and nauseous taste. According to the experiments of Mitscherlich, it is, in considerable quantity, poisonous, and appears to act like alcohol—first stimulant and then depressing. In large doses it destroyed the entire mucous membrane of the stomach.§

Cyanol, one of the organic bases in coal-gas naphtha, is equally poisonous, according to Hoffman.||

I subjoin with great unwillingness, but borne down by the weight of authority, *Sulphate of quinine*. In large doses, it would certainly seem to have proved poisonous to animals and to man. On dissection, there is observed to be much congestion of the brain and lungs. In several instances, indeed, by Recamier, Baldwin, and others, blindness, convulsions, and delirium have occurred, and inflammation of the brain has been found.

The administration of any liquid containing tannin is proper as an antidote, although emetics should also be given.

* London and Edinburgh Monthly Journal, vol. ii. p. 943.

† Edinburgh Medical and Surgical Journal, vol. lii. p. 291.

‡ Corneliani, British and Foreign Medical Review, vol. i. p. 265. Cormack on Creosote. Edinburgh, 1836.

§ London Medical Gazette, vol. xxxv. p. 430.

|| London, Edinburgh, and Dublin Philosophical Magazine, vol. xxiv. p. 125.

I had formerly been of the opinion that these results were impossible, from the large doses that the practitioners in the Southern States were in the habit of giving with impunity, and indeed success. Nor was the idea of an impure article to be entertained, since the quinine from the government stores was used by the army surgeons in very large doses.

I have thrown in the following note a catalogue of such noxious plants and their products, unarranged in the various classes of poisons, as I have met with during the preparation of this work.

Some are of our own country, while others are foreign, and probably the majority belong to the narcotico-acrids:—

Sanguinaria canadensis L. (Blood-root, Puccoon.) A native of the United States. This is considered by Dr. Bigelow as an acrid narcotic. A dose of from eight to twenty grains of the fresh powdered root produces irritation of the fauces, heartburn, nausea, faintness, and frequently vertigo, and diminished vision. Vomiting is occasionally produced. (Bigelow's Medical Botany, vol. i. p. 79. Dr. Mease mentions, on the authority of Dr. Muhlberg, that a temporary insanity was produced in a female from swallowing the seeds. (Coxe's Medical Museum, vol. ii. p. 161.) Professor Tully's elaborate essay on this plant will be found in the American Medical Recorder, vol. xiii. p. 1. Professor Dana discovered an alkaloid in it, denominated *sanguinarine*; and Schiel, a German, has rediscovered (1843) it. (Encyclographie des Sciences Médicales, March, 1843.)

A few years since, during the month of July, while four individuals (three females and one male) were engaged in cleaning and whitewashing the apothecary department of the Bellevue Hospital, they drank, out of a demijohn left there, a large quantity of the tincture of blood-root, mistaking it for some intoxicating liquor. They were all soon seized with racking and burning pains, and a tormenting thirst, but concealed from the physician what they had taken until it was too late to relieve them. They all died during the ensuing day. Their bodies decomposed very rapidly, and were so excessively distended that the coffins burst. (New York Medical Gazette, vol. i. p. 172.)

Dirca palustris, L. (Swamp leather-wood.) A native of this country. The berries are poisonous. (Rafinesque's Medical Flora, vol. i. p. 160.) The bark is acrid, and, in doses of six or eight grains, causes vomiting, and sometimes catharsis. (Bigelow.) From its affinity to the genus *Daphne*, it is probably an acrid poison.

Chaillatia toxicaria, and *C. erecta*, Don. Mr. Don observes that these grow on the mountains of Sierra Leone. "The English name of the first species is *rathane*. There is a deadly poison prepared from the kernel of the fruit, by the negroes, which they use for the purpose of poisoning rats; whence its name." The kernels of the other species possess similar poisonous properties. (Edinburgh Philosophical Journal, vol. xi. p. 348.)

Robinia pseudo-acacia, L. Dr. Gendron, of Montpelier, relates of some schoolboys who had chewed the bark of the root, and swallowed the juice, and in whom in three hours were presented symptoms of narcotic acrid poison, as vomiting, lethargy, and slight convulsions. (Philadelphia Journal of Pharmacy, vol. vi. p. 285.)

Piscidia erythina, L. (Fish-wood, Jamaica dog-wood.) The bark is thrown into the water to intoxicate fish. Dr. Hamilton tried its effects on himself in the form of tincture. It produced some irritation, which was succeeded by profound sleep. (Burnett's Outlines of Botany, vol. ii. p. 654.) Hamilton, in Pharmaceutical Journal, vol. iv. pp. 76, 111. Lindley speaks of it as a narcotic.

Abrus precatorius, L. The scarlet seeds of this plant are used as necklaces and rosaries. It is the common opinion that they are poisonous. Indeed, a single one, swallowed by a child, is said to have caused death. (Edinburgh Encyclopedia, vol. xv. p. 808, American edition.) See also Ainslie's Materia Indica, vol. ii. p. 80; and Penny Magazine, vol. ii. p. 211. Burnett, (Outlines, vol. ii. p. 666,) however, doubts this, and says that they are eaten in Egypt. Lindley agrees with Burnett.

Hura crepitans, L. (Sand-box, Monkey's dinner-bell.) So called from the noise of its capsules breaking. The seeds of this plant, according to Aublet, are poisonous. It vomits and purges in a dose of two grains. A native of Guiana, (Annales d'Hygiène, vol. vii. p. 200. Burnett's Outlines of Botany, vol. vii. p. 607.) Probably an acrid poison. Its milk, when applied to the eye, caused blindness.

Anda gomesii, Jussieu. Grows in Brazil. The decoction of the bark is used by the native for stupefying fish. An oil is obtained from the seeds, which is both cathartic and emetic. (Burnett, vol. ii. p. 609. F. Smith, in Philadelphia Journal of Pharmacy, vol. iv. p. 26.)

Æsculus ohioensis, Michaux. *Æ. pallida*, Willdenow? (Buckeye.) Dr. Drake states that cattle are poisoned by eating the nuts. It induces gastritis, and they are previously affected with vertigo and trembling of the limbs. (Notes to Desalle, p. 9. Dr. Short, in Transylvania Journal of Medicine, vol. i. p. 422.) It is undoubtedly an acrid narcotic. See Riddle's Flora.

Æsculus pavia, L. *Pavia rubra*, Lam. (Buckeye.) "The narcotic property of this shrub has given rise to a singular mode of taking fish, practiced, though not unfrequently, in some parts of this State. The tender branches are bruised, and thrown into a pool of small extent; the water is then agitated until it becomes sufficiently impregnated to affect the fish; they rise to the surface almost lifeless, and may be taken by the hand. The powdered seed may be used with equal effect. Fish taken in this manner are eaten with impunity." (Elliot's Botany of South Carolina and Georgia, vol. i. p. 435.)

Melia azedarach, L. (Pride of China or India, Poison-berry tree, China-tree.) A native of the East, but also grows in our Southern States. Elliot observes that its decoction is narcotic; and it was mentioned in the newspapers some time since, that a child had died from eating the seeds. Dr. Heustie remarks that if exhibited in too large quantities "it is highly

poisonous, affecting more especially the head and eyes, and sometimes causing total blindness." (Elliot's Botany, vol. i. p. 476. Barton's Materia Medica, part i. p. 41. American Journal of Medical Sciences, vol. viii. p. 82. Ainslie's Materia Indica, vol. ii. p. 456. Dr. Griffith, in Philadelphia Journal of Pharmacy, vol. vii. p. 180.)

Amyris toxifolia, toxifera, Willd. (Janca or White candle-wood.) This is said to be a native of Carolina; and a black juice which distills from the trunk of this tree is stated to be very poisonous. (Burnett's Outlines of Botany, vol. ii. p. 875.)

Polygala venenosa, Juss. A native of Java. Commerson says "that even from gathering a few of its leaves and branches, he was attacked with giddiness and sickness, and other unpleasant symptoms." (Burnett's Med. Botany, vol. ii.)

Passiflora quadrangularis, L. (Barbadine.) A strong infusion of its root produced catalepsy and death in a dog; and on dissection, the arachnoid membrane was found injected, the vessels of the lungs all filled, and black blood in the heart. (Dr. Ricord Madianna, in Annals of the New York Lyceum, vol. i. p. 129.) It is a native of the Isle of France, but cultivated in Guadalupe. It is said to owe its activity to a peculiar principle called *passiflorine*.

Chenopodium murale, L. (Wormseed.) A native of the Southern States. Dr. Henry Wilkins, of Baltimore, states that he has known of two instances of children convulsed for an hour, from swallowing the seeds. (Coxe's Med. Museum, vol. v. p. 256.)

Gelsemium nitidum, Michaux. (Yellow jessamine. *Bignonia sempervirens*, L.) The flowers, root, etc. of this shrub, are narcotic, and the effluvia from the former are said sometimes to induce stupor. Dr. Mease mentions that a child died in Charleston, S. C., from eating the flowers. (Elliot's Botany of South Carolina and Georgia, vol. i. p. 312. Memoirs of the Philadelphia Agricultural Society, vol. v. p. 244.) In the newspapers of May, 1823, it is mentioned that a child of Mr. Broughton, of North Carolina, aged two years, died in the space of two hours, after eating the flowers of this plant. Blindness ensued within a minute or two after swallowing it. See Professor Tully's Experiments, in Boston Med. and Surgical Journal, vol. vii. p. 117.

Kalmia latifolia, L. (Mountain-laurel. Laurel in Pennsylvania, Bay in Virginia.) A native of the United States. Barton says that the Delawares (Indians) poison themselves with a decoction of this plant. It is poisonous to some animals, as cattle and sheep; and in man, a very small quantity of the decoction has produced vertigo and convulsions. (Barton's Medical and Physical Journal, vol. i. part i. p. 147. Barton's Materia Medica, part i. p. 18. Bigelow's Medical Botany, vol. i. pp. 137, 139. A recent instance of its deleterious effect on sheep is given in the Penny Magazine, 1838, p. 283.)

Gaultheria procumbens (Spicy winter-green) and *Andromeda* are allied genera to the Kalmias. In the Annals of Medicine, vol. iii. p. 364, is a case by Dr. Longmore, of a number of soldiers poisoned at Quebec, from a tea made of the andromeda, gaultheria, and ledum. It produced vertigo, weakness, vomiting, cold sweats, and in one case insensibility. They gradually

recovered, after extreme debility. See also Barton's *Materia Medica*, part i. p. 19. Bees which feed on the azalea, rhododendron, and kalmia, are supposed to produce poisonous honey.

Senecio obovatus, Willd. A native of this State. It is said to have proved a deadly poison to sheep. (*Silliman's Journal*, vol. xv. p. 358.)

Arnica montana, L. (Leopard's bane, Mountain tobacco.) Chevallier and Lassaigne have detected cytisine in it. (*Duncan's Supplement*, p. 27.)

Echites suberecta, Jacq. (Savanna flower of Jamaica.) According to Mr. Sells, two drachms of the expressed juice of this plant killed a dog. Animals and men have been destroyed by it. Some negroes attempted to poison an overseer by putting a quantity of the powdered root into water intended for drinking, but it was detected. Six grains of the powdered root were given to a dog; death followed in less than three hours. (*Brande's Journal*, N. S., vol. iii. p. 502.) Dr. Hamilton states that the milk of this plant is a deadly poison, and often fatal to cattle that browse upon it. He also mentions cases fatal to man. (*Pharmaceutical Journal*, vol. vi. p. 23.)

Spigelia marilandica, L. Pink-root. A native of the United States. This, in large doses, is a violent poison. Its decoction produced vertigo, dimness of sight, and pain, in two children who took it; one vomited, but was not relieved; staggering, incoherent talking, and delirium took place, until they all fell asleep; they awoke relieved. The pupils were dilated during the influence of the poison. Dr. Chalmers attributes the loss of two children, who died in convulsions, to this article. (*Edinburgh Physical and Literary Essays*, vol. i. p. 438. Dr. Lining, *ibid.*, vol. iii. p. 149. Dr. Garden, *Barton's Medical and Physical Journal*, vol. i. part ii. p. 74. Dr. W. P. Barton's *Medical Botany*, vol. ii. p. 80. Bigelow's *Medical Botany*, vol. i. p. 146.)

Spigelia anthelmia, L. (Brinvilliers.) A native of the West Indies. This, according to Dr. Ricord, (*Recherches et Experiences sur les poisons d'Amérique*), is a violent poison to animals, destroying a dog in two hours, when the juice of the leaves was employed. The stomach and intestines were throughout contracted, as if from spasm, but their mucous membrane was pale. The heart, both auricles, and ventricles were distended with black blood. Dr. R. supposes it to be one of the poisons in use among the negroes.

Hemanthus toxicarius, Aiton, (the old *Amaryllis toxicaria*, or *distacha*), is the plant with which it is said the Hottentots poison their arrows. Weapons wetted with the juice of the bulb convey certain death by the slightest wound: dissolution is preceded by violent struggles and efforts to vomit. (*Burnett's Outlines of Botany*, vol. i. p. 448.)

Amaryllis atamasco, L. (Atamasco lily, Stagger-grass.) Southern States. Generally supposed to be poisonous to cattle, and to produce the disease in calves called *staggers*. (*Elliot's Botany of South Carolina and Georgia*, vol. i. p. 384.)

Helonius erythrosperma, Mich. (Red-seeded helonias, fly poison.*) Southern States. This plant is a narcotic poison, and is employed by some families for destroying the house fly. It is mixed with honey or molasses. The

* *Amianthum muscætoxicum*. (GRAY.)

flies, unless swept into the fire, or otherwise destroyed, revive in the course of twenty-four hours. (Elliot's Botany of South Carolina and Georgia, vol. i. p. 421.) Dr. Tulley has experimented on this. (Boston Medical and Surgical Journal, vol. vii. p. 136.)

Caladium seguinum,* Vent. I add this on the authority of some remarks extracted from Hooker's Exotic Flora. This plant is a native of the West Indies, and is there called *dumb-cane*, from the fact that its virulent juice, when applied to the tongue, causes a swelling which deprives the sufferer of the power of speech. From its affinity to the genus *Arum*, it is probably an acrid poison. The *Caladium arborescens* is so caustic that occasionally (says Merat) the lips of negroes are wetted with it, as a punishment for slight misdemeanors. (Edinburgh Philosophical Journal, vol. vii. p. 395; Coxe's Medical Museum, vol. i. p. 185; Burnett's Outlines of Botany, vol. i. p. 411.)

Symplocarpus fatida, Salisbury. *Ictodes fatidus*, Bigelow. (Skunk cabbage.) A native of the United States. This plant emits a very pungent odor from the spathe and flower. Dr. Barton was seized with inflammation of the eyes, in consequence of the necessary examination which he gave to it. A dose of thirty grains of the root has caused vomiting, headache, vertigo, and temporary blindness. (Dr. W. P. Barton's Medical Botany, art. *Symplocarpus*; Bigelow's Medical Botany, vol. ii. p. 48.)

This plant has been analyzed by Mr. Turner, but without discovering any peculiar noxious principle. (Philadelphia Journal of Pharmacy, vol. viii. p. 1.)

Festuca quadridentata, Kunth. *Sessleria quitensis* of Sprengel is, according to Humboldt, poisonous to animals. (Pereira, London Medical Gazette, vol. xvii. p. 4.)

Equisetum hyemale, L. (Scour grass.) A native of the United States. I formerly placed this among the irritant poisons, but I am now convinced that its noxious qualities are owing to the silex contained in it. According to the analysis of Braconnot, out of the ashes furnished by the dried plant, more than half is silex. There is no question that horses and cattle are sometimes destroyed from eating it; and, on examination, the stomach is found cut and lacerated. (Edinburgh New Philosophical Journal, vol. viii. p. 101; Barton's Medical and Physical Journal, vol. i. part i. p. 149; Nuttall's Journey in the Arkansas, p. 58.)

Phaseolus multiflorus. (Scarlet runner.) The roots are said to be poisonous, although the beans are eaten.

Diospyros virginiana. (Persimmon.) Dr. Zollikoffer gives an instance in which the seed produced serious consequences, but these, I apprehend, are attributable rather to the quantity taken than to a poisonous quality. (Philadelphia Medical Examiner, vol. iii. p. 198.)

Lonicera xylosteum. (*Caprifolium dumetorum*.) Dr. Blattmann relates the case of a child, five years old, who, after eating some of the berries of the plant, was seized with vomiting and purging, dilatation of the pupils, small, quick, and irregular pulse, and indeed all the ordinary symptoms of poison-

* Called *Dieffenbachia seguina*, by Pereira.

ing. He was relieved by the usual remedies. This case led to experiments on rabbits, and from three to seven of the berries were found sufficient to kill young ones in a few hours. Unless the berries were fresh, they induced no noxious effects, and Dr. Blattmann hence supposes that the poisonous quality resides in the empyreumatic oil which they contain, and which has the property of volatilizing after a few days. A student in pharmacy, while preparing a syrup from the fresh fruit, was seriously affected for some time in his sight. Dr. B. arranges this substance with the narcotico-acrids. (*Encyclographie des Sciences Médicales*, 4th series, vol. xii. p. 218, from *Pommer's Zeitschrift*.)

Yedra. "The most remarkable shrub in this country (California) is the Yedra, a poisonous plant affecting only particular constitutions of the human body, by producing tumors and violent inflammation upon any part with which it comes in contact, and indeed even the exhalation from it, borne upon the wind, is said to have an effect upon some people. It is a slender shrub, preferring cool and shady places, and bears a trefoil crenated leaf." (Capt. Beech's Narrative vol. ii. p. 84.)

Singhera. An East India poison. See an account of it by Mr. Burnard, from the *India Medical Journal*. (*London Medical Gazette*, vol. xviii. p. 447.)

The following are taken from Dr. Lindley's *Flora Medica* :

Lagenaria vulgaris. (Bottle gourd.) "In the wild state, this plant produces poisonous fruit. Some sailors died at one of our outposts, a few years since, from drinking beer that had been standing in a flask made of a bottle gourd. Dr. Royle says that he learned from a very respectable and intelligent native doctor, attached to the jail hospital at Saharumpore, that he had seen a case of poisoning from eating of the bitter pulp, in which the symptoms were those of cholera." (Page 84.) The above plant is the cucurbita *lagenaria*, L.

Argemone mexicana, Toura. The seeds are said to be powerfully narcotic.

Excæcoria agallocha, L. Native of India. Its juice causes inflammation and ulceration.

Erythroxylon coca, Lam. Much used by the Peruvians. Its effects are similar to, but less violent than, those of opium.

Anagyris fatida, L. Seeds said to be poisonous like those of *cytiscus laburnum*.

Tephrosia toxicaria, Pers. (*Galega toxicaria*.) Used in Jamaica to poison fish. The pounded leaves are thrown into the water.

Geoffræa inermis, Swartz. (*Audira inermis*.) The bark is drastic, emetic, purgative, and narcotic, poisonous in large doses, producing violent vomiting, with fever and delirium.

Comocladia dentata, Jacquin. "It is supposed by the natives of Cuba that it is death to sleep beneath its shade, especially for persons of a sanguine or fat habit of body. This is firmly believed, and there can be no doubt that it is the most dangerous plant upon the island."

Ficus demonia, Vahl. Sea-coast of Tangore. Juice extremely poisonous. *F. toxicaria*, L. Juice a virulent poison.

Pettiveria alliacea, L. All the parts are excessively acrid. The negroes in the West Indies employ it to procure abortion.

Cestrum venenatum, Thunb. "A decoction of the bark reduced to the thickness of jelly, is used by the Hottentots to envenom their weapons. It is said to be a fatal poison, and to be also used by the same people to destroy wild beasts, by impregnating baits of flesh with its juice."

Crinum toxicarium, Roxb. East Indies. The bulbs are powerfully emetic.

Helonias frigida. (*Veratrum frigidum*, Schlecht.) A poisonous plant, called *savæja* by the Mexicans. Horses that eat it become stupefied.

Gloriosa superba, L. Has a root which is said to be a most violent poison.

Pistia stratiotes, L. The whole plant is acrid. In Jamaica it communicates this quality to the water-tanks in which it grows, and is said to give rise to the bloody flux.

COMPOUND POISONING.

It is to be expected that when two poisons of different or opposite properties have been taken, their effects will vary materially from those produced by either singly. The known facts on this subject, however, consist at present only of individual cases, and I will mention some of the more important:

Arsenic and corrosive sublimate. An individual took about fifty grains of each, mixed together, for the purpose of suicide; but experiencing a burning heat in his bowels in about five minutes, took an emetic, which caused him to evacuate a portion of the poison. Excruciating pain and severe thirst were present. By the aid of emetics and diluents he became somewhat relieved. A diarrhoea ensued, which lasted eight days. On the second day, besides this, vomiting recurred, with convulsive twitchings. The treatment was directed to the removal of inflammation. Under this he improved, but was delirious a portion of the time. On the sixth day, mercurial ptyalism commenced, and although extremely weak, the immediate dangerous symptoms subsided, and he gradually, but slowly, convalesced.*

Arsenic and laudanum. Mr. Jennings relates a case where a female swallowed two drachms of arsenic and three ounces of laudanum at the same time. He saw her in four hours after. There was no pain or burning in the throat, stomach,

* Julia Fontanelle, in Archives Générales; Medico-Chirurgical Review, vol. vii. p. 565.

or bowels, no tenderness of the abdomen, and no particular stupor. She complained merely of being tired and sleepy, from the violent effects of an emetic about two hours previously. The eyes were bloodshot and heavy, the pupils contracted, and the pulse 100. All the usual symptoms of arsenic were absent. An emetic, venesection, leeches, blistering, and the cold affusion were prescribed, and she was kept walking; but the drowsiness increased, and she finally became comatose, and died in that state, with dilated pupils and laborious breathing, about nine hours after taking the poison. There had been no pain in the stomach, and the bowels were but once moved.

On dissection, the membranes of the brain were found vascular, the sinuses gorged, the large veins filled with a treacly-like blood, the ventricles free of fluid, the brain firm, and its bloody points unusually numerous. The stomach was externally healthy. It contained half a pint of fluid. Its villous coat was generally pale, but at the great arch there were two small red patches. The small intestines were red, and some had patches. The heart was rather flaccid, and its great vessels were not gorged with blood. Arsenic was obtained from the fluids of the stomach.*

The interest of this case, and the others cited below, is heightened by an experiment of Lassaigne, (*Journal de Chimie Médicale*, April, 1841.) He injected, through an incision in the œsophagus, into the stomach of a stout dog, ten grains of arsenic in solution and all the soluble parts of three drachms of opium. A ligature was placed on the penis, to prevent the excretion of urine. Shortly after, the animal appeared to experience nausea, and foamed at the mouth, but in a quarter of an hour he was quiet. The effects of narcotism increased, and in three hours he was dead.

Dissection was immediately practised. The liver and heart were removed, and all the blood as well as urine were collected for examination. Portions of each of these were then tested

* *Edinburgh Medical and Surgical Journal*, vol. xxxv. p. 453, from London Medical and Physical Journal, October, 1830. There is another case by Mr. Scott, in which the effects of the arsenic decidedly predominated, and the mucous membrane of the stomach was readily detached after death. (*Medico-Chirurgical Review*, vol. xi. p. 170.)

for arsenic, but without success. Traces of it were indeed discovered, but not sufficiently decisive to warrant the assertion of its presence.

Attempts were next made to ascertain the presence of opium. A portion of the urine evaporated down was tested with salts of the peroxide of iron and with nitric acid, but no indications either of meconic acid or of morphine were manifested. The blood was next examined, and then a portion of the liver, but with equal ill success.

The deductions of Lassaigue from this case are as follows:

1. Opium, mixed with arsenious acid, acts on the stomach so as to prevent the rapid absorption of the mineral poison.
2. Although death in this instance undoubtedly ensued from the combined action of the two poisons, yet traces of their presence cannot *chemically* be detected in the viscera or fluids.

Arsenic and alcohol. Two cases of this description are mentioned by Dr. Christison. In one, the arsenic was taken after a meal. After ineffectual attempts to produce vomiting by emetics, the stomach-pump was used, and a fluid brought up in which arsenic was detected; but no symptom of arsenical poisoning followed. Dr. Christison imagines that the operation of it was prevented by the narcotism previously induced by the ardent spirits. In the other instance related by Dr. Wood, of Dumfries, where half an ounce of arsenic was taken early in the morning, after a night's debauch, there was no symptom but languor and drowsiness. A few minutes afterwards he had slight vomiting, which was repeatedly renewed. In eighteen hours he presented the usual constitutional symptoms of poisoning with arsenic, and in forty-one hours he expired. But from first to last he had scarcely any local symptom except vomiting, although the stomach presented, after death, signs of violent irritation.*

Arsenic and nux vomica. A female in Liverpool took two drachms of arsenic and half a drachm of nux vomica. It was soon discovered, and an emetic of sulph. zinc was given, which produced vomiting. The stomach-pump was also used. Subsequent to this, copious draughts of lime-water and mucilage

* Christison, p. 808.

were prescribed. The symptoms that succeeded were those of severe gastric inflammation, which yielded to the repeated application of leeches and a milk diet. She was discharged cured on the sixteenth day.*

Corrosive sublimate and laudanum. Two drachms of the former and a half an ounce of the latter were swallowed by a young soldier at Edinburgh. He had at first no violent symptoms whatever indicating the operation of corrosive sublimate, but afterwards suffered under purging, tenesmus, and bloody stools. There was, however, no pain or tenderness of the abdomen. On the fourth day a violent salivation commenced, and under this and the dysentery he sunk; yet not so much but that on the day of his death, the ninth day after he took the poison, he was able to walk a little in his room without assistance. The stomach and intestines were enormously inflamed, ulcerated, and here and there almost gangrenous. Dr. Christison, who received this case from Dr. Mackintosh, imagines that the narcotic operation of the opium retarded the irritant action of the corrosive sublimate.†

Corrosive sublimate, sulphate of copper, and a tincture of the sesquichloride of iron. This constitutes what is called "gun-barrel browning." A child, five years old, swallowed a considerable quantity. He endeavored in vain to vomit, had much pain in the epigastrium, and his pulse was feeble and quick. He was perfectly rational, although listless and heavy. Copious draughts of milk, combined with white of eggs, were given. These induced frequent vomiting, and the patient soon became relieved. A gentle emetic of ipecacuanha, to remove the consequent torpor of the stomach, acted kindly, and a gentle perspiration, followed by a quiet sleep, left him convalescent.

In this case the albumen doubtless acted as an antidote to the salts of both mercury and copper.‡

Acetate of lead and opium, even in large doses, would seem to counteract each other. Thirty grains of opium and sixteen of acetate, intended for a lotion, were swallowed by a sailor in

* British Annals of Medicine, vol. ii. p. 81.

† Christison, p. 809.

‡ London Medical Gazette, April, 1841.

the New York Hospital, without any bad effects. The acetic acid decomposes the opium and forms acetate of morphine.*

Lead and nux vomica. A young female died in consequence of taking a solution of acetate of lead and some nux vomica. On dissection, the blood-vessels of the brain were found much distended; the mucous membrane of the stomach was entire, not thickened but somewhat ecchymosed. The other parts were natural.

Dr. R. D. Thompson analyzed the contents of the stomach and obtained strychnine sufficient to kill a bird. Lead in a metallic state was also procured, and it deserves mention that the smell of the fluid matters taken from the stomach was strongly acetous.†

Tartar emetic and charcoal fumes. An individual, after swallowing seventeen grains of the former, attempted to commit suicide by suffocating himself with the fumes of burning charcoal. He recovered from both attempts; suffered severely from the usual narcotic effects of carbonic acid gas, but showed scarcely any of the symptoms of the action of tartar emetic.

Opium and belladonna. The lady of a medical man took successively three injections, each containing a scruple of opium and half an ounce of the leaves of belladonna. They were all returned. This was in the evening. During the night her husband became alarmed at her profound sleep, and sent for aid. The pupils were extremely dilated, the tongue dry, deglutition difficult, respiration short and frequent, and the pulse 130. The limbs were perfectly motionless, and the skin insensible to irritation. Purgatives, venesection, and sinapisms were used with success, but the vision remained indistinct for the next day.‡

Laudanum and alcohol. The excitement of intoxication sometimes suspends for a time the action of laudanum, but the symptoms of stupor then occur. In one instance, seen by Dr. Christison, there was no delay, and the narcotism came on in one hour, and death succeeded in four more.§

* Dr. Buck, New York Journal Medicine and Surgery, October, 1840.

† British Annals of Medicine, vol. i. p. 103.

‡ Medico-Chirurgical Review, vol. xvii. p. 563.

§ Christison, p. 809.

Orfila has published an elaborate memoir on the detection of mixed poisons. I can mention only a few of his formulæ:

Mixture of corrosive sublimate and arsenious acid. These are separated by adding sulphuric ether, and shaking the mixture until the sublimate is dissolved. The liquor is then evaporated to obtain it. This will apply, whether the mixture be in the solid or fluid state.

Corrosive sublimate and acetate of copper. Here also ether is to be used as in the last, the acetate not being soluble in it.

Corrosive sublimate and tartar emetic, the same process.

Arsenious acid and tartar emetic. Boil the mixture with carbonate of potash. Soluble arsenite and tartrate of potash and oxide of antimony will be obtained. The latter is soluble in hydrochloric acid, affording hydrochlorate of antimony. Treat the fluid with sulphuretted hydrogen, and a few drops of hydrochloric acid and sulphuret of arsenic will be precipitated.

Laudanum and arsenious acid. Filter and apply sulphuretted hydrogen. The laudanum dissolves only a small portion of the acid.*

* The memoir of Orfila may be found in the *Annales d'Hygiène*, vol. vii. p. 627; and an analysis of it in *American Journal of Medical Sciences*, vol. xi. p. 179.

CHAPTER XXII.

MEDICAL EVIDENCE.*

Why physicians are called as witnesses; statutory regulations on this in various countries. Duties of the medical witness before the coroner and his jury. Neglect of medico-legal examinations. Capacity of all medical men to be witnesses. Necessity of the appointment of medico-legal examiners by the State. Regulations in Austria—Prussia; practical school of legal medicine in the latter country. Defects of the present system in England and the United States; duties of medical men while it remains in force. Medical witnesses before a court; rules for their conduct in the statement of facts—in giving opinions. Fluctuations of opinion on several subjects of importance—Hydrostatic test in infanticide. The witness to avoid being a partisan. Testimony to be estimated according to the skill and knowledge of the witness. Difference of opinion; rule on this in the Scotch courts; a reference to authorities proper. Divulging of secrets. Validity of death-bed declarations.

A WORK on medical jurisprudence is manifestly incomplete unless it embrace a special chapter on medical evidence. The opinion of the physician is often required by those charged with the administration of justice, in cases of sudden death, or of grievous bodily injury. This naturally results from a due regard to the interests of society.

The first necessity to the administration of equal and exact justice is, that in every case the *best evidence* within reach of

* I take great pleasure in stating that the present chapter has been subjected to the revision and correction of Hon. JOHN C. SPENCER, and that I have availed myself of his valuable suggestions. [In revising this chapter, I have found so many things which have been rendered unavailable by the lapse of time, that I have made alterations and additions much more freely than to any other part of the book. These changes are sometimes indicated, though generally they are not. To those who are curious to know exactly what belongs to author and what to editor, I am well content to say—"If it is good, let him have the praise; if bad, let the blame rest with me."—C. R. G.]

the tribunal shall be obtained. Hence, when a controversy originates in mercantile disputes, the testimony of merchants is sought for, and their customs and usages are often considered as part of the law. So when death or serious bodily harm has, or is supposed to have, resulted from injuries or criminal neglect, the physician, whose ordinary pursuits and studies give him special knowledge or skill, is expected not only to investigate the facts, but also to give his opinion as to their nature. The propriety of this course is indicated in one of the edicts of Charlemagne; but it was not till near the middle of the sixteenth century (1532) that the Emperor Charles V., in the celebrated Caroline Code, ordained that the opinion of medical men should be taken in every case of violent death, as child-murder, poisoning, wounds, drowning, hanging, and the like. Most of the continental nations soon followed this example. In England, however, there never has been any provision by statute on this subject. Custom, sanctioned by judicial dicta, has supplied this omission, and rendered an appeal to medical testimony, in the cases referred to, obligatory on the magistrate. "It is the duty of the coroner, in case of death in a pugilistic encounter, to examine a surgeon as to the cause of death."* The Revised Statutes declare that it shall be the duty of the coroner to cause some surgeon or physician to be subpoenaed to appear as a witness, on taking an inquest.† The coroner has the power to compel the physician or surgeon to attend and testify, but he cannot oblige him to make post-mortem examinations, or chemical analyses. The law has a right to the knowledge actually possessed by the witness, but cannot compel him to increase that knowledge. In England, by a late statute, (6 and 7 Guil. IV., cap. lxxxix.,) the coroner is empowered to remunerate the medical witnesses. No such provision exists in New York. In Virginia, the coroner is authorized to summon one or more medical witnesses, and to give them reasonable compensation.‡ In

* 4 Carrington and Payne, 571. *Rex v. Quinch.*

† Revised Statutes, vol. ii. p. 742.

‡ Med. News and Library.

Georgia, a similar provision is made, and liberal fees awarded.* Still, even in New York, when post-mortems, and especially chemical analyses are required, the coroner does pay the witnesses, charging their fee to the county, and this will always be done if the medical man insist, as he certainly should do, that he will not perform the service without proper compensation. Another of the *rights* of the medical witness, which he should always claim, is that of making a post-mortem examination, if he deem it necessary. Ignorant coroners will often object to this as, in their (*worshipful!*) judgment, unnecessary. Such impertinent interference should always be resisted, the physician refusing to give any opinion unless he is allowed to take the necessary means of forming a correct one. It is the plain duty of the medical witness to *satisfy himself* as to the cause of death.

He should proceed to a dissection if he entertains the slightest doubt, and he has the right to demand this, or as an alternative, to deny his testimony. If this be properly understood, the doubt that some have advanced, whether in law, it is *imperative* on the coroner to have the body opened, is of little importance.† At the present day, physicians at least need not be told that an external view alone of the body is perfectly nugatory, and that it can lead to no certain deduction, and that a jury is quite as competent to form an opinion upon it as many practitioners. The jury is sworn “diligently to inquire and true presentment make,” *how and in what manner*, the deceased came to his death. Let the medical witness, when subpoenaed, impress this on the coroner and his jury, and decline any testimony unless he be permitted to satisfy his own mind and conscience.‡

* Southern Med. and Surgical Reporter.

† London Medical Repository, vol. xxiv. p. 578; Medico-Chirurgical Review, vol. vi. p. 562.

‡ “We cannot omit this opportunity of expressing our disapprobation of the conduct of coroners who presume to interrupt the medical practitioner called upon to examine the cause of death under suspicious circumstances; and of informing practitioners in general, that as soon as the body is delivered over to them for that purpose, they are to proceed deliberately with their examination until they be satisfied. Upon this subject, we quote with great satisfaction the opinion of the enlightened judge who now presides

It is very important that the medical witness should be aware of the somewhat peculiar position he occupies, and the twofold character in which he appears, when giving evidence in a court of justice.

He may be examined as (what is technically called) a *common witness*, merely to state, as any other witness might do, the facts that have fallen under his observation; but besides this, he is often, and indeed almost always, required as a *skilled witness*, technically an *expert*, to interpret the facts he has observed, or to give opinions on facts observed by others.

As a common witness, the physician is only required to state facts. This he should do in the simplest and most intelligible terms, avoiding, as much as possible, the use of technicalities, and if compelled to use them, which an intelligent man very seldom need be, explaining them so fully that no man on the jury can fail to understand exactly what is meant. As a very general rule, it is better to confine your answer to the specific point or points embraced in the question. Sometimes, however, a fact may be known to the witness of which the examining counsel is ignorant, and which yet has an important bearing on the case. This should always be stated, but rather to the judge at the close of the examination or cross-examination, than to counsel.

[The medical witness will find it for his advantage to manifest the greatest deference to the judge; it is far better to exceed than to fall short in this matter.—C. R. G.]

It would at first seem hardly necessary to say that in his detail of facts, the witness should be perfectly candid and open, never for a moment taking thought as to what effect the fact stated may have on the issue of the trial. "Nothing extenuate, nor set down aught in malice," is the obvious dictate of common honesty; yet those who have listened to many cross-examina-

over the criminal court of this division of the empire. Dr. Cleghorn, of Glasgow, having been examined in a trial for poison, the Lord Justice Clerk, after highly complimenting the learned professor on his luminous evidence, took occasion to impress strongly on all magistrates and public officers present, the absolute necessity of having the body of the deceased opened and examined by a medical man in every case of suspicious death." (Edinburgh Med. and Surgical Journal, vol. xiv. p. 468.)

tions of medical witnesses will not fail to call to mind instances where a disposition to keep something back has been disgracefully obvious. Now this is one of those things which Talleyrand called "worse than a crime—a blunder." It is the business of the lawyer to drag the truth out of unwilling witnesses, and it is "a labor they delight in," which not only "physics pain," but is very sure to physic the physician. Perfect candor is the only safe, honest, or honorable course. [The notions of Abernethy seem to have been very loose upon this subject. Speaking of giving evidence in case of infanticide, he says: "I think it is your duty to try to weaken the effect of your testimony on this point." What has a witness to do with the effect of his testimony?—C. R. G.] But the difficulties of a medical man upon the stand do not ordinarily arise in his examination as a common witness; with a fair measure of candor and intelligence, he will do very well when detailing facts—it is when he comes to interpreting these facts, when he testifies to matters of opinion, that he is apt to blunder, often disgracing himself, still oftener discrediting his profession.

There are several reasons why this should be so: First, few men hold their opinions so definitely that they are able to state them with accuracy and precision, especially when called on to do so in public and in a new position. Second, it is infinitely more difficult to prevent a bias as to the general merits of the case, from coloring our opinions, than from affecting our statement of facts. Third, medical witnesses are very often induced to give an opinion on part of a case, on a single symptom, or at most, a few, and this being entirely different from that which he has given or may give, when the facts are before him, leads to an apparent self-contradiction. The witness is in this way often "made to express the very opposite of his real opinion."* [Fourth, many very conscientious witnesses are afraid to swear to matters of opinion, where life is at stake. "I think as you do," said an amiable friend to me, "but I would not swear to it in a case of life and death, since I may be mistaken." Influenced by this kindly feeling, the opinion is given, if indeed it be given at all, in so dilute a form,

* Edinburgh Med. and Surg. Journal, vol. xix. p. 611.

that when it comes to be sifted by cross-examination, and categorical answers demanded, the witness, fearful that he may send a fellow-creature to the gallows, will give an opinion, if not diametrically opposite, at least utterly unlike that which he really holds. In this case a man does wrong by mere force of ill-directed efforts not to do wrong. Let us look at this matter a little closely. Those who are charged with the administration of the law demand, as they have a right to do, the opinion of the expert on a certain state of facts. They do not require him to state what the truth is, but what *he thinks* it is. Now if he gives his honest, unbiased opinion, he is clearly not responsible for the use which the law may make of it. "But," he says, "I may be mistaken." Here again is a great error. This is precisely the thing about which you cannot be mistaken. If you swear that you saw John strike Peter, you may be entirely mistaken; it may turn out that it was another man much resembling John that you saw. Cases of mistaken identity are common. But if you swear that, in *your opinion*, the blow John struck was the cause of Peter's death, you cannot be mistaken. That is your opinion, and whether sound or not—a thing for the jury to decide—still it remains your opinion, and that it is so, is all to which you swear.—C. R. G.]* The last source of difficulty in testifying to matters of opinion to which I shall advert is, that medical men are sometimes tempted to testify to an opinion, when, in point of fact, they have none. A man is asked his opinion as to the nature of a disease, the import of a symptom, the probable effect of a remedy—he knows nothing about it, and consequently has no opinion. But he is unwilling to say so. "If," he reasons, "I confess that I do not know this, they will think I know nothing." Very bad logic. The better reasoning is: "If you say that you do not know what you do not, your claim to know will be readily admitted whenever you make it." Having thus indicated the chief difficulties in the way of the skilled witness, we will add a few hints on the best way of avoiding them.

* Mr. Abernethy was sharply reprov'd for refusing to give his opinion in a case, and told by the judge, "You were called for the purpose of giving an opinion." (London Lancet, vol. xii. p. 227.)

First, study accuracy and definiteness in the formation of your opinions; never rest satisfied in diagnosis with vague generalities—"it is something of that sort," etc. When your opinions are formed, give them to the court just as they are; do not, by vagueness of expression, try to make your statement cover all the ground, or mean everything or anything; but give them such terms that they shall express exactly what you mean—nothing more, nothing less. As to bias, whether affecting the statement of facts or (what is much more likely) of opinions, it is only to be avoided by constant watchfulness and rigid self-discipline. The danger of allowing one's self to take sides in the cause as to its merits, is well shown by the expressions which fall unconsciously from writers on medical evidence. Even Guy says: "No man can be justified in consenting to *appear for either party*, until having heard all the facts on which his opinion must be formed, he can conscientiously give evidence *in favor of the party for whom he is retained*." Here it seems to be taken for granted that the witness must "appear for one party," that he is "retained for that party." This obviously strikes at the root of all correct principles of medical testifying. The witness is not retained for one party; he does not testify for or against one or the other party. He gives the facts if they have fallen under his observation, and his opinion upon any supposed state of facts. A good plan, I think, is to talk not exclusively with the lawyer or the witnesses on one side, but hold, if possible, free intercourse with those of the other party. Hear what they have to say and try the effect on your own mind of looking on the facts of the case from *their stand point*.

By thus following the good old rule *audi alteram partem*, you avoid in great degree the danger of giving an opinion on half the case. If you have no opportunity of communicating with "the other side," you cannot be too cautious in giving opinions on the statement of the case from counsel engaged in it. I believe they cannot, certainly they never do, state the facts just as they are, even to their own skilled witnesses. Hold yourself, therefore, in reserve; tell the lawyer: "It seems to be so;" "my impression certainly is so and so;" but beware of committing yourself. It is always his object to induce you

so to pledge yourself, as it were, to his side. It should be yours to avoid such premature self-committal. As to the responsibility in giving opinions under oath, nothing need be added to what has been urged above; and, finally, as to giving opinions when you really have none, let me assure my inexperienced readers that they little know the advantage which a skilled witness derives from an occasional "*I do not know*," nor the force that such a candid confession of ignorance gives to his "*I do know*," when he has right and proper occasion to use it.

Medical evidence before the coroner.

In all cases of death under suspicious circumstances, the cause of death is investigated by the coroner. As before stated, it is made his duty to summon a physician or surgeon in every case, and he has the ordinary power to compel the attendance of the witness. The great object of the coroner's inquest is to collect the facts in the case. It is, of course, often necessary for the medical witness to give an opinion upon these facts to the coroner's jury; but the merits and weight of such opinions are seldom there canvassed. [For this very reason the medical witness should be all the more cautious in giving his opinion, for though it is very true that its merit and weight will not be then and there canvassed, yet being taken down by the coroner, and reproduced in the higher courts, the medical man will often be embarrassed by finding himself committed to an opinion formed hastily and without due consideration of the facts.—C. R. G.] It enters into the very essence of the duties of the coroner *to view the body*; an inquest taken without this is void. This done, evidence is produced as to the cause of death. The evidence taken down by the coroner is afterwards read to the witness, to be corrected by him if necessary; it is then signed by him. In giving evidence before the coroner, it is important that the medical witness should be aware of his rights and his duties. His rights are—1st. To refuse to give his opinion unless he is allowed to make such post-mortem examinations and chemical analyses as are necessary to enable him to form a sound opinion. 2d. He may refuse to make

either post-mortem examinations or analyses, without being assured of proper [not extravagant—C. R. G.] compensation. His duties are—to attend when summoned, to state all the facts within his knowledge, and to give, when required, his opinion on them. The success of the medical witness in these cases will greatly depend upon his own prudence and reserve in stating facts, but especially in giving opinions upon them. It is much to be regretted that the proceedings before the coroner are so often hurried over. It cannot be denied that a full and satisfactory medico-legal examination is often avoided, and even when judicially ordered, its proper objects thwarted or not fully accomplished. The consequences may be seen in the results of many of our criminal trials. The public mind may be deeply impressed with the guilt of the accused, and yet the imperfection of the early examination be such as to leave no option to the jury but an acquittal. This evil result sometimes flows from the ignorance and presumption of the coroner—as in an English case of suspected murder, where the examining surgeon was directed to content himself with an external examination of the body; and in another in Scotland, where the sheriff held that the opening of the body supposed to be poisoned with arsenic was unnecessary, as incapable of furnishing additional proof.

But the instances are still more common in which the discovery of the truth is prevented by presumption and ignorance on the part of those who undertake the examination. We hear every day of medical practitioners giving their evidence with the utmost confidence on points which it is obvious they never considered with the requisite attention, stating facts as universal which admit of many exceptions, or rejecting them altogether because exceptions do exist, and destroying evidence or failing to discover it, from not knowing where it is to be found, nor how it is to be obtained.

The most important part of the medical testimony before a coroner's inquest is the report of the post-mortem examinations, and of the chemical analyses, if any have been made. To perform these examinations with deliberation and accuracy, it is of the greatest importance that two or more professional persons should be associated together. They will assist each

other, not merely mechanically, but by suggesting various points of inquiry. While one is pursuing his dissections, the other may note down the appearances as they successively present themselves. The same course may be adopted in performing chemical analysis. The advantage will thus be obtained of having a complete statement of the facts prepared at the moment of observation.*

In Scotland, "medical or other scientific reports which are lodged in process before the trial, and libeled on as productions in the indictment, are allowed to be read as a deposition to the jury, the witness confirming it at its close by a declaration on his oath that it is a true report. He is, however, liable to an examination and cross-examination."† The law in England and in this country relative to the admissibility of such notes is very definite, and is very strictly insisted on by the judges. 1st. The witness can only use them to refresh his memory; if he have no recollection of the fact except as he finds it in his notes, the evidence is not good. 2d. The notes should be taken on the spot at the time the observations are made, or as soon thereafter as may be. They should not be copied.

When the examination before the coroner is completed and the charge of guilt is made, the duties of the medical witness have but just commenced. He has to appear before another tribunal to state the facts noticed, the opinion deduced from these facts, and the reasons for that opinion. He may be, and indeed frequently is, called upon to defend them against the objections of other medical witnesses; and, above all, he has to undergo a severe and minute inquiry by gentlemen of the bar, whose business it is to invalidate, if possible, all that he has said.

* I subjoin here a note by Mr. Spencer in his own words: "In the absence of any legal provision on the subject, the examining physician would find it much to his advantage if he should reduce to writing on the spot all the appearances of the body, and all the circumstances of the examination. Although these notes would not be evidence in themselves, yet they may be used by the physician when testifying as a witness on the trial to refresh his memory. They will not only give him great confidence in the accuracy of his recollection, but will revive many minute circumstances which might otherwise escape him, and his testimony will be strongly corroborated."

† Alison's Practice of the Criminal Law of Scotland, p. 541.

This branch of our subject cannot be approached without adverting with some feeling of professional pride to the certainty which has been attained in many branches of medical jurisprudence. It is surely no mean effort of human skill to be brought to a dead body, disinterred perhaps after it has lain for months, or even years in the grave; to examine its morbid condition; to analyze the fluids contained in it; (often in the smallest possible quantities,) and from a course of deductions founded in the strictest logic, to pronounce an opinion, which combined circumstances or the confession of the criminal, prove to be correct.* And this, if properly done, must be accomplished without listening to rumor, and without permitting prejudice to operate. Many again, by their researches, have saved the innocent, showing that accident or natural causes have produced all the phenomena.

The first point worthy of recommendation is the importance of stating the facts observed in plain and perspicuous language. The use of technical terms is often unavoidable, and precision and accuracy must be sacrificed if they be not adopted: but there is a medium in all this. Many parts can be named by their common appellation, and the appearances observed designated by words in ordinary use. The imputation of pedantry is thus avoided, and every aid is given to a clear understanding of the case. It should be remembered that most persons are quite ignorant of the meaning of technical terms and of Latin phrases, and if it be necessary to use them, translations or explanations should be given at the same time. The doctrine founded on the facts should next be mentioned in an unequivocal manner, so at once to evince the decided belief of the witness in it, and the reasons on which it is established. If 'it

* It is such duties, ably performed, that raise our profession to an exalted rank in the eyes of the world; that cause the vulgar, who are ever ready to exclaim against the inutility of medicine, to marvel at the mysterious power by which an atom of arsenic, mingled amidst a mass of confused ingesta, can still be detected. It does more: it impresses on the minds of assassins, who resort to poison, a salutary dread of the great impossibility of escaping discovery. (*Quarterly Journal of Foreign Medicine and Surgery*, vol. iv. p. 45.)

be open to doubt, he should intimate this, and also the reasons for it, before they are drawn out by a cross-examination.*

[It is difficult to decide how far the medical witness should submit to the dictation of judges. As to lawyers, of course their attempts should "pass by him like the idle wind, which he regards not;" but as to judges, the case is a little different. Generally the more eminent will not err in this matter, but sometimes even they will, like "the charming woman," talk of things that they don't understand, and talk very confidently, too.—C. R. G.] For example, Baron Garrow, some years since, congratulated a grand jury that the "scientific humbug" (the Hydrostatic test) was abandoned. Nothing, he added, could be more fallacious.† In another case, the same learned pundit stopped the medical witness, who was about to state his experiments, (the Hydrostatic test,) and declared "it was a vulgar error." In a case tried at Essex assizes, March, 1820, the chief baron declared the test fallacious. Again, in a late trial, Mr. Justice Littledale said to the medical witness: "You do not appear old enough to have seen the late Dr. Wm. Hunter, but you must know that he was one of the most celebrated surgeons of this country, and that he asserted that no dependence was to be placed on the test you rely on." It was well answered: "I am aware that was his opinion, but I

* "Be the plainest men in the world," said Sir William Blizard, some years since, to his pupils, "in a court of justice; never harbor a thought that if you do not appear positive you must appear little and mean ever after; many old practitioners have erred in this respect. Give your evidence in as concise, plain, and yet clear a manner as possible; be intelligent, candid, open, and just, never aiming at appearing unnecessarily scientific: state all the sources by which you have gained your information. If you can, make your evidence a self-evident truth; thus, though the court may at the time have too good or too mean an opinion of your judgment, yet they must deem you an honest man. Never, then, be dogmatic, or set yourself up for judge and jury; take no side whatever; be impartial and you will be honest. In courts of judicature, you will frequently hear the counselors complain when a surgeon gives his opinion with any the least kind of doubt, that he does not speak clearly; but if he is loud and positive, if he is technical and dogmatic, then he is allowed to be clear and right. I am sorry to have it to observe that this is too frequently the case." (London Medical and Physical Journal, vol. xxi. p. 403.)

† Edinburgh Med. and Surgical Journal, vol. xix. p. 450.

entertain a different one, and I believe mine is now the received theory among medical men." "Then," said the justice, "it must be within the last year or two, for I have heard some of the most eminent of them deny it."

The reply given to Judge Littledale is perhaps as good an example as can be given of the mode in which judicial dictation should be met. While the utmost courtesy is extended to the bench, the dignity of our science and its progressive character must be vindicated. [This can be done very effectually, without any abatement of that deference of manner recommended on a preceding page. Indeed, it is a good plan to let the deference and submission of *manner* increase just as the resistance to judicial dictation is more decided.—C. R. G.]

The medical witness is often placed in a delicate situation, from the circumstances under which he is summoned. He is called as a witness for one or other party—for the prosecution or for the prisoner; and he is so summoned, in the belief that his evidence will favor the side by which he is produced. It would be desirable that at least the person who has made the previous examination before the coroner's jury should be divested of this, so far as to enable him to give a full and fair statement of all the circumstances that make for either side. I am aware that he can now do so, and indeed his oath obliges him to do it. He ought to put the judge and jury in possession of the "*whole truth*," even if he be not questioned to that extent.* But often the technicalities of an examination, and

* G. Smith's *Forensic Medicine*, p. 8, first edition. An interesting case occurred some years since in France, in which the question was submitted, whether an accused person can be allowed MEDICAL council.

A female, in France, was accused of poisoning her husband and children. The bodies were disinterred fifteen days after death, and a medico-legal examination was ordered. The woman, confined in prison, sent for Dr. Alirol, and desired him to attend the examination on her behalf.

Dr. A. communicated this wish to the district attorney, (*procureur de roi*,) and was refused, on the ground that the examination was necessarily a secret one, even as it regards the accused. The editors of the *Gazette de Hôpitaux*, to whom these facts are communicated, and from whom Dr. Alirol asks advice, give it as their opinion that the present is a case in which a chemist, on the part of the accused, should be allowed to be present, and to

particularly by an adverse counsel, overcome that self-possession which is so essential. Pressed by perplexing questions, and probably irritated in his feelings, he is apt to make declarations more strongly corroborative of opinions that he has formerly advanced; and as his examination progresses, he may incur the charge of being *biased*, more than facts will warrant.

We have now supposed the facts to be in evidence. The next difficulty, and it is the great one in most cases, is the interpretation of these facts, the opinion which the experts form upon them. Here those differences in opinion, which so often in courts of justice puzzle judges and discredit medical witnesses, usually take their rise. The witnesses disagree on the bearing and weight of certain facts, and the inferences to be drawn from them; and these differences will be exaggerated by the lawyers, each of whom will try to drive the witness as far to his side, and of course apart, as possible. Much of this could doubtless be avoided if the medical witnesses on either part could meet and consult together; as this is not ordinarily possible, the differences will remain, and each witness must make his evidence as strong as possible. For this purpose it is necessary he should be aware:—

First. That his opinion must be based exclusively upon the medical facts of the case. "It is not the province of the ex-

witness the methods pursued for the detection of the supposed poison. If this be refused, the difficulty of defending the accused is greatly increased, as the medical witness for her will only be informed of such facts as may come out on the trial.

The same rule, they insist, should apply in cases where a dissection is necessary, with the understanding that the medical friend of the accused is in no way to impede the appointed examiners, or to interpose obstacles in their way.

Finally, it is suggested, whether the ends of substantial and equal justice would not be best promoted in every case, if all these examinations were conducted by individuals nominated both by the accuser and accused. Certainly much of the discordance in opinion that now constantly occurs between medical witnesses might thus be avoided. (*Encyclographie des Sciences Medicales*, vol. v. p. 376.) "In this country, the party implicated would be allowed to have such a witness present."—J. C. S.

See *Reg. v. Spry and Dove*, *Coxe's Criminal Cases*, vol. iii. p. 221.

pert to draw inferences of fact from the evidence, but to give his opinion on a known or hypothetical state of the facts."*

Second. Physicians are not allowed to give their opinions on the case as it is submitted to the jury. In the case of *Reg. v. Pate*, a medical witness said: "From all I have heard to-day, and from my personal observation, I am satisfied the prisoner is of unsound mind." For this he was sharply rebuked by Baron Alderson, who added, "*I will not permit any medical witness to usurp the functions of both judge and jury.*"† So in *Jameson v. Dunkald*, 2 Moore's Rep., p. 128, it was held that, "when scientific men are called as witnesses, they are not entitled to give their opinions on the merits of the case, but only to the facts proved on trial." In *Rex v. Wright, Russel and Ryan*, p. 456: "Several of the judges doubted whether the witness could be asked his opinion on the very point which the jury were to decide, viz., whether, from the testimony given in the case, the act as to which the prisoner was charged was, in his opinion, an act of insanity."‡ But they all thought that in such a case a witness of medical skill might be asked whether, in his judgment, such and such appearances were symptoms of insanity—and that by such questions the effect of his testimony in favor of the prisoner might be got at in an unexceptional manner. "In this country, the present practice, when medical men are examined as experts, is to ask their opinion as to a hypothetical state of facts. If they happen to have been present during the whole trial, they may be asked their opinion as to the particular facts, supposing them to be true; but the determination of the truth or falsity of the evidence itself should be reserved exclusively for the jury."§ Medical opinions, when given under these restrictions, do not, as is well observed by Briand, "usurp the functions, but only serve to enlighten the consciences of the judge and jury."

Third. Medical men are not usually allowed to quote the

* Mr. Joshua Curtis, in *U. S. v. McGlue*, 1 Curtis' U. S. Reports, 1.

† Blackwood's Magazine, November, 1850, p. 559.

‡ See 19 Wendell, 576, where other cases are cited.—J. C. S.

§ Wharton and Stillé, p. 77.

books of authority in their profession to fortify the opinions they may have given in the case. In *Collier v. Simpson*, 5 Car. and Payne, 73, it being proposed to put in medical books of authority, to show what were the received opinions in the medical profession, Tindal, C. J., said: "I think I cannot receive medical books. You may ask the witness whether, in the course of his reading, he has found this laid down. I do not think that the books themselves can be read, but I see no objection to asking the witness his judgment, and the grounds of it, which may in some degree be founded on books, as a part of his general knowledge." "It may be remarked that this does not apply to medical books alone, but as well to treatises on law or any other science. These may sometimes be read to inform the mind of the court, but never as evidence. A general history of a country may be read, not precisely as evidence, but to refresh the memory of the court as to general facts which it is presumed to know."—J. C. S.

The practice under this rule does not seem to have been very uniform. *As long ago as the trial of Spencer Cowper, when Dr. Crell referred to medical authorities, it was objected to by the bench. Dr. Crell remonstrated. "My lord," said he, "it must be by reading as well as a man's own experience that will make any one a physician, for without the reading of books in that art, the art itself cannot be attained to. I humbly conceive that, in such a difficult case as this, we ought to have great deference for the reports and opinions of learned men. Neither do I see any reason why I should not quote the fathers of my profession in this case, as well as you gentlemen of the long robe quote Coke upon Littleton in others."* The doctor was allowed to proceed in his own way. But, *per contra*, in *Rex v. Downal*, for poisoning, when Dr. Neale quoted Thenard, Justice Abbot said: We cannot take the fact from any publication; we cannot take the fact as related by strangers. Against this exclusion of the written authorities of their profession, medical men have protested very vehemently. The editors of the *Edinburgh Med. and Surg. Journal*, vol. xix. p. 480, say: "It appears to us that no witness

* Hargrave's State Trials.

can follow, this advice without compromising the right and dignity of his profession, as well as the force of his evidence; for it would not be difficult to show that medical evidence altogether is little else than a reference to authority." And again: "The practice of the English judges in excluding a reference to authors evidently arises from the principle in law that nothing is evidence which is not delivered upon oath. But is an oath more binding than the solemn act of sincerity between the author and the world by the very act of publication? Would Paris and Fonblanque be better authority if they swore to it before the twelve judges? And is it not manifest that, if the exclusion be made to act systematically, it must inevitably end in excluding medical and scientific evidence altogether? For scientific inquiries at law can scarcely be anything else than a tissue of references to written authorities. Of what use would be all the personal experience of any physician, unless he knew, by referring to that of his predecessors, the conclusions he is entitled to draw from it?"*

[With all proper deference to the learned editors and to the memory of good Dr. Crell, their complaint seems to have but little basis when we look at the reason of the admission and exclusion as given above by the clear-minded Spencer. If a general history can be read only to refresh the memory of the court as to something it is supposed to know, surely that affords no pretence for the reading of Thenard's Chemistry, of which the court was sure to know nothing; and so of Coke upon Littleton, etc. As to the legal rule "excluding medical and scientific evidence altogether," does not Tindal's dictum open the door wide enough to satisfy any reasonable man? "You may ask," says he, "the witness whether, in the course of his reading, he has found this laid down; you may ask his judgment, and *the grounds of it*, which may in some degree be *founded upon books*, as a part of his general knowledge."

What more than this can medical science ask? That the exclusion of medical books arises from no disposition to undervalue medical learning, is shown by the severe but well-deserved reproof which Chief Justice Dallas gave to a flippant

* Edinburgh Med. and Surgical Journal, vol. xix. p. 610.

medical witness who spoke slightly of books, saying that "the writers of books would advance anything." "I will not sit here," said the learned judge, "and hear science reviled by *ignorant tongues*, and the recorded researches of the medical world misrepresented, as leading only to uncertainty."—C. R. G.]

"It is not settled whether, when one medical man contradicts another on the point of opinion, it is competent to re-examine the first in order to clear up the difficulty. In a late case this point occurred. Lords Gilles and Meadowbank were for admitting the re-examination, and the Lords Justices Clerk and Hermand against it. The examination, under these circumstances, was not pressed by the crown."

[In practice there is great inconsistency in the matter of allowing the use of medical authorities. They are usually shut out; yet the very judge who refuses to allow a medical witness to refer to books, will, in the same case, quote from these authorities; and the lawyers, while they object to books, will often refer to them, and even ask the witness whether this or that writer is a good authority, and when an affirmative answer is obtained, quote the book to contradict the testimony of the witness.]

There remain two points of which it is proper to apprise the medical witness.

One is, that in England he may be called upon to divulge *secrets* intrusted to him in professional confidence. It was solemnly decided in the case of the Duchess of Kingston, that in a court of justice, medical men are bound to divulge these secrets when required to do so. In a recent case, where a female was indicted for the murder of her infant child, Mr. Cozzens, the surgeon, was called to prove certain confessions made by her to him. He objected on the ground that he was, when she made ~~her~~ statement, attending her as surgeon. But Justice Park observed that this was not a sufficient reason to prevent a disclosure for the purpose of justice, and he was ordered to answer; but the prisoner was acquitted on other grounds.*

* 1 Carrington and Payne's Reports, p. 97, *Rex v. Gibbons*.

The law in France is of an opposite description. The Penal Code, Art. 378, directs that if physicians, surgeons, officers of health, and also apothecaries, midwives, and all other persons, depositaries of secrets, either through their condition or profession, shall reveal these secrets, (except in cases where the law obliges them,) they shall be punished with fine and imprisonment; and in another place it is clearly indicated that the exception has reference to crimes that *put the safety of the state at hazard*.*

I have noticed the following adjudications under this law:—

In December, 1842, Dr. Mallet, of La Rochelle, delivered a lady, who had placed herself under his care on the condition of secrecy. The laws of France require the registration of a birth at the mayoralty of the parish in which the child is born, within three days of the delivery, under the terror of a severe penalty for the omission. Dr. Mallet accordingly presented the child, on the second day, to the registrar of the town, merely giving the date, the place of birth, and some names, under which the child was inscribed. He was summoned, however, to give in also the name of the *mother*, but this he refused to present, on the plea that it had been intrusted to him under a promise of secrecy, and that Art. 378 of the Penal Code decrees “that all medical men or midwives, who reveal secrets which have been intrusted to them in their professional capacity, shall be punished.” The civil authorities of Rochelle brought an action against him, on the ground that the declaration of the birth of the child was legally imperative on the accoucheur, and such other person or persons as were present at the delivery. But the Tribunal of Saintes, before which the case was brought, acquitted Dr. Mallet, on the ground that by presenting the child at the register office, accompanied by two witnesses, he had satisfied the exigencies, of the law, and that he was really warranted in refusing to name the mother, by the article of the code just quoted, which enjoins secrecy when such secrecy *does not threaten or endanger the security of the public*.

The attorney-general of Saintes was not satisfied with this

* Briand's Manual, second edition, p. 499.

decision, and appealed to the court of cassation at Paris. But that court, after a lengthened debate, confirmed the decision of the provincial tribunal, and on similar grounds.*

On the 7th of December, 1844, Dr. Saint-Pair, surgeon in the French navy, was summoned before a judicial officer at Point Petre, in the island of Guadaloupe, and the following questions were put to him: "Are you in attendance on M. Giraud, wounded some days since in a duel? Where is the wound situated, and for how many days will he be incapacitated from pursuing his ordinary avocations?"

Dr. Saint-Pair replied, that an answer to these questions would elicit facts acquired in the exercise of his profession, and which, by the terms of the code, he supposed he ought not to answer.

This judge, in his opinion, stated that the 378th Article was intended to forbid the revelation of secrets with an intent to defame or injure; but it did not follow that professional persons could be absolved from answering when summoned before legal tribunals for that purpose, and when their answers were necessary for the preservation of good order and the public morals. That the revealing forbidden in the article, certainly could have no reference to information concerning a wound criminally received; that Dr. Saint-Pair would, undoubtedly, not refuse answering, if called as a witness in a case of poisoning; that dueling was now also a crime, and not one *sui generis*, and therefore the fashionable prejudice about that practice ought not to be allowed to interrupt the course of the law. He therefore fined the witness 150 francs.

Some time after, Dr. Saint Pair was summoned before the court of assizes on the same matter, and again objected, but, as it appears, on different grounds, to answering.

The court, on the 29th of January, 1845, decided that although the general principle was correct, that a witness should answer in a court of justice, still in the instance of physicians, there ought to be an exception in the case of facts confidentially communicated. And although they could not admit the broad defence made by the witness, yet as he had testified

* *Lancet*, October 7, 1843.

before the court, that in this instance the communication had been confidential, and that he had been secretly brought to the wounded person, they would not hear him as a witness.

From the decision of the judge "*d'instruction*" Dr. Saint-Pair appealed, and from that of the court, the king's attorney.

The doctor called to his aid a medical association in Paris, to which Orfila, Fouquier, Adelon, etc., belong. They caused an elaborate pleading to be prepared by eminent counsel, and the cause was argued before the court of cassation, on the 28th of July, 1845.

The decision was as follows:—

The court is of opinion that no text of law, no principles of justice or of morals, can absolve physicians from the obligation of answering on all matters about which they may become acquainted during the practice of their profession, and that hence the judge of instruction has properly applied the provisions of the penal code.

But it was very different when an oath of secrecy had been taken, and therefore, as to the second appeal, it was decided that as it appears from the reasons of the court of assizes that the witness was confidentially introduced to the patient, and was sworn to secrecy in his medical attendance, the court violated no law in refusing to punish him.*

In the State of New York the following provision is in force:—

"No person duly authorized to practise physic and surgery, shall be allowed to disclose any information which he may have acquired in attending any patient in a professional character, and which information it was necessary to enable him to prescribe for such patient as a physician, or to do any act for him as a surgeon."†

Confessions. It may sometimes be necessary that the attending physician should receive from his patient confessions of guilt, but it seems to me that this should be avoided, as far as possible, and that we should receive any confessions or admissions which are afterwards to be used against our patient,

* Gazette des Tribunaux, July 27 and August 2, 1845.

† Revised Statutes, 406.

only at his urgent request. Even when thus requested, it is far better that the medical man should not act alone; some respectable, and, if possible, intelligent person—it matters not whether man or woman—should hear the confession with the doctor, and attest the record, which should be made at once, and as much as possible in the words of the declarant. This should, in all cases, be signed by him. When about to receive such a confession, the physician should bear in mind that the confession, to be of any legal value, must be, in the strictest sense of the word, *spontaneous*. If obtained by any threats or promises, direct or indirect, or any inducements, however vague, (as, that he had better confess, or, it will be better for him,) or if any influence of whatever kind be used, the confession is void. Not only should the physician abstain from all improper influence, but he should see to it that nothing of the kind is attempted by others. Another very important part of his duty is, to scrutinize most closely the state of mind of the patient. Is his sanity entirely unquestionable, his mind clear, his memory reliable? Dr. Southwood Smith quotes a case where a whole community was thrown into commotion by a confession made by a young man in a delirium of fever. The reputation of several young ladies was most seriously compromised when his confession was most indiscreetly made public. The patient luckily survived to contradict his crazy confession, which he declared had no sort of foundation.

Guy quotes from the London Times the case of a poor woman, who confessed she had murdered her child, minutely describing the way in which it was done. Yet the evidence of other parties (medical men) proved conclusively that the woman was entirely innocent, in fact a most affectionate and devoted mother. She had shown symptoms of insanity.

Death-bed declarations must be made under the apprehension of impending death. It is not essential that the party should apprehend *immediate* dissolution—it is sufficient if he apprehend it to be impending; and under such circumstances, these declarations, if made to the medical attendant, or any other person, are received as valid testimony. [It is not essential that the deceased should have expressed in words his consciousness of the near approach of death; this may be legally

inferred from his conduct, from the nature of his wounds, or from other circumstances.] But the "person making them must entertain no hopes of recovery." On the trial of Mr. Christie and Mr. Trail, for the murder of Mr. John Scott, the editor of the London Magazine, and author of various works, in a duel, Dr. Darling, who had attended the deceased after he had received his wound, deposed that he heard Mr. Scott, on his death-bed, say—

MR. JUSTICE BAILEY. Did Mr. Scott, at that time, think himself in danger? did he give up all hopes of recovery?

MR. DARLING. No; to the last he entertained hopes of recovery.

MR. JUSTICE BAILEY. The declaration made by a dying man cannot be received as evidence, unless the party, at the time of making it, were satisfied that recovery is impossible.*

An interesting point, as to dying declarations, came up before the supreme court of Massachusetts, in the case of *Commonwealth v. Casey*, tried in May, 1830. On the 17th of September, 1829, Taylor and his wife were severely wounded by some party, who escaped at the time. When the house was visited Taylor was found dead; his wife, though grievously wounded, survived till the 21st. Though so severely injured as to be unable to speak, Mrs. T. retained her consciousness; she recognized her children and friends, understood the questions put to her, and was aware of her hopeless condition, and that she was in fact at the point of death. She was asked whether it was Thomas Casey who inflicted the wounds, and if so, she was desired to squeeze the hand of the person asking the question. She took her hand from beneath the bed-clothes, grasped the

* Starkie on Evidence, vol. ii. p. 460; Ryan, p. 301; Paris and Fonblanque, vol. i. p. 166. "Two days before the death of the deceased, the surgeon told her she was in a very precarious state; on the day before her death, when she had become much worse, she said to the surgeon that she found herself growing worse, and that she had been in hopes that she should have got better, but as she was getting worse, she thought it her duty to mention what had taken place. Immediately after this, she made a statement. Held, that this statement was not receivable in evidence as a declaration in articulo mortis, for that it did not sufficiently appear that, at the time of making it, the deceased was without hope of recovery. *Regina v. Megson*." (Carrington and Payne's Reports, vol. ix. p. 418.)

hand of the querist, squeezed it for about half a minute, and then let it go. This was repeated to at least four physicians in succession, at different times.

The court, on the objection to the admissibility of this kind of evidence, observed that all words were signs; some are made by the mouth, and others by the hands. If the injured party had but the action of a single finger, and with that finger pointed to the words yes or no, in answer to questions, in such a manner as to render it probable that she understood and was at the same time conscious that she could not recover, then it was admissible evidence.*

I will close this chapter by a single quotation. Although it refers to another country, yet physicians should understand that in our own the legal profession is paying great attention to medical jurisprudence. How imperative, then, the duty of fitting themselves as medical witnesses!

"Medical practitioners should be aware that all the rising barristers of our courts attend lectures on legal medicine; and often does forensic fame arise from the ability with which an advocate examines a medical witness."†

* Monthly Law Reporter, August, 1853.

† Ryan, Preface, p. 9.

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